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METALLURGIST

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LET US APPROPRIATELY CELEBRATE METALLURGIST'S DAY

Translated from Metallurg, No. 7,
p. 1, July, 1961

The metallurgists of our country will have a double holiday this year: July 16 is Metallurgist's Day,and October 17 is the day the 22nd Congress of the Communist Party of the Soviet Union opens. Three months separate these two notable events; therefore, gifts to Metallurgist's Day are the metallurgists' gifts to the Congress.

The news of the convocation of the 22nd Congress of the Communist Party of the Soviet Union aroused the entire Soviet population. Articles and letters are printed daily in the press expressing the progress in fulfilling the pledges taken in honor of the 22nd Party Congress.

The steelworkers of Magnitka at the beginning of the year appealed to all metallurgists of the southern Urals to develop a competition for an appropriate celebration of the 22nd Congress. They resolved to smelt in the third year of the Seven-Year Plan as much steel in each open-hearth furnace as was produced by the leading collective of the No. 6 furnace. This will permit them to produce tens of thousands of tons of steel over the plan, to reduce the duration of each melt to 11 hr and 50 min (12 hr and 12 min in 1960), to reduce down times by 0.5% against the plan, to reduce rejects to 0.38%, and to increase the productivity of labor by 0.5%.

The entire collective of the Magnitogorsk collective resolved to produce over the plan by opening day of the 22nd Congress 125,000 t of ore, 50,000 t of sinter, 21,000 t of pig iron, 45,000 t of steel, and 25,000 t of rolled products.

The metallurgists of other enterprises of the Urals are not to be outdone by the Magnitogorsk workers. Having developed a competition for appropriately celebrating Metallurgist's Day and the 22nd Party Congress, the metallurgists of the Sverdlovsk Council of the National Economy during the first four months of 1961 fulfilled the plan for gross output by 103.3% and produced in excess of the plan 44,100 t of sinter, 35,700 t of pig iron, 17,900 t of steel, and 15,600 t of rolled products; the productivity of labor was increased by 2% against the plan. The steelworkers of the Verkhiset' Plant turned to the metallurgists of the region with the suggestion to produce thousands of tons of metal over the plan in honor of the opening of the 22nd Party Congress.

The famous collective of steelmakers of the Nizhni Tagil Combine headed by steelworkers Ya. M. Kal'nichenko, Yu. M. Zashlyapin, Yu. P. Ploskonenko, and T. Ye. Obraztsov suggested organizing a review of the technology of the metallurgical industry.

The Alchevskii Metallurgical Plant is one of the largest enterprises in the Donets Basin. The fulfillment of the plan in the entire region depends in many respects on how it fulfills the plan. Having entered into the competition for appropriately celebrating the 22nd Party Congress, the metallurgists of the Voroshilov Plant pledged to produce in excess of the plan 20,000 t of sinter, 4000 t of pig iron, 11,000 t of steel, 18,500 t of rolled products.

Each era in each country has its distinctive marks, its singular characteristics. The '60s will enter into the history of the development of the Soviet State as the years of communist construction, as years of the formation and development of new forms of labor.

Two years have already passed since, on the initiative of the Communists and Komsomols, the depot of the Moscow marshalling yard developed a movement for communist labor. All the best features of our people, who are endeavoring to live and work communistically were concentrated in this movement.

No enterprise exists where the movement for communist labor has not been developed. Brigades, departments, shops, and entire plants have enlisted in the struggle for the right to bear this honorable title.

Hundreds of new Collectives of Communist Labor will appear by the day the 22nd Party Congress opens. From all corners of our great Motherland news arrives concerning the labor gifts which the workers are preparing for the 22nd Party Congress. And invariably the metallurgists, these people producing metal for the national economy are standing in the front ranks of fighters for an appropriate celebration of the 22nd Congress.

From Magnitka and Rustavi, Kazakhstan and the Donbas, the Moscow area and the Dnieper region the metallurgists report on the gifts to Metallurgist's Day and on their readiness to greet the 22nd Congress of the Communist Party of the Soviet Union with new, even higher indexes. And this means that the country will receive hundreds of thousands of tons of pig iron, steel and rolled products over the plan, this means that new tractors, machines, lathes, and equipment will appear in our country, this means that still another step bringing us closer to Communism will be made.

THE INDUSTRIAL INNOVATORS SPEAK

Translated from Metallurg, No. 7
pp. 2-3, July, 1961

Comrade Pesterov. Operator at the Cold-Rolling Shop of the Leningrad Steel-Rolling Plant.

The powerful 400-reversing mill at which I work is designed to roll cold steel strip to a size of 3.00-0.2 mm at a speed up to 600 m/min. The mill was put into operation in November, 1959. We worked on temporary norms during the period in which we mastered the mill. But already in January, 1960 we reached an average hourly production of 2.38 t, in February 2.44 t, and in March 3.06 t.

In June, operator B. Aleksyev and I requested the administration of the shop to re-examine our production norms since they were already antiquated. Our request was satisfied. On the average the norm was increased by 15%; this saved a sum of money such as would be required to pay a worker for the output of 1000 t of cold-rolled steel strip.

In January, the average hourly production was 4.32 t, in February 4.34 t. Our brigade contended for the high rank of Brigade of Communist Labor. We pledged to the 22nd Congress of the Communist Party of the Soviet Union toreach an average hourly production of 5 t of cold-rolled strip. Our brigade has gone all out to win the honorable title Brigade of Communist Labor by the day the 22nd Party Congress opens.

Comrade Didenko. Hero of Socialist Labor, Blooming-Mill Operator at the Magnitogorsk Metallurgical Combine.

The second brigade of the No. 2 blooming mill honorably bears the high rank of Collective of Communist Labor, which was awarded to us as the first among the rolling shops of the combine.

The brigade in which I work fulfilled the 1960 plan by December 24. The country received from us many thousands of tons of rolled products in excess of the plan. The collective of the brigade noticeably increased the discipline, many are studying in schools, technical schools, and institutes. Having seriously discussed the material of the January Plenum of the Central Committee of the Communist Party of the Soviet Union, we undertook increased pledges. Our brigade turned out good work in January and February: over 4000 t of rolled products were produced over the plan. We constantly struggle to reduce the amount of rejects and the expenditures for steelmaking. Rejects were reduced by 50% in January and February in comparison with last year. Our brigade will do everything possible to celebrate appropriately the 22nd Party Congress.

Comrade Koshkarov. Rolling-Mill Operator at the Pervoural' New-Tube Plant.

Since demobilization from the ranks of the Soviet Army in 1954, I have been working as a rolling-mill operator on the mill for cold-rolling tubes. I mainly roll stainless steel tubes on this mill. The mills for cold-rolling tubes are the most complex rolling equipment. The heavy loads on the units and parts and the complexity of the mill's mechanisms frequently cause considerably down times. The mechanics of the trick brigade usually make the current repairs. The rolling-mill operator and assistant were not always able to repair the mill due to the lack of sufficient skill in mechanics. I and my shift hands, M. A. Nikitin and P. V. Khlebnikov, having mastered the technology of mechanics, were able to help the mechanics in repairing the mill. After changing over to a seven-hour working day (at the end of 1958) and a four-brigade working schedule, we had the opportunity to help the mechanics carry out preventive maintenance.

In September,1959 we decided to drop the services of the trick mechanics during the shift. The mechanic could not always respond rapidly to calls since there are many mills in the shop. When he arrives at the mill, the mechanic defines the character of the trouble or breakdown, then goes off for tools and spare parts, and time is lost. The rolling-mill operator working on the mill knows better where the trouble lies and he himself can make minor repairs with the same competency as the mechanic and considerably more quickly.

During the first two months of working without mechanics the down times were reduced by 31%, the norm was fulfilled by 110%, the productivity of labor increased by 7.6% and the yield of suitable rolled products was 100%. Our initiative is now being picked up on 68 mills at the plant, which will make possible the release of 52 mechanics. As a result of reducing down times and increasing the productivity of labor in 1960, I finished fulfilling the plan ahead of schedule (by 1 December) and produced 9500 tons of tubes over the plan. In January and February,1961 I fulfilled the norms by 107-109% and produced 100% suitable rolled products. I pledged to produce 12,000 tons of tubes over the plan in honor of the 22nd Party Congress.

Comrade Sukharev. Hearth Attendant of the No. 2 Blast Furnace of the Magnitogorsk Metallurgical Combine.

In 1960 the Collective of Communist Labor of the No. 2 blast furnace produced more than 14,000 t of pig iron, and in the first two months of 1961 about 1500 t over the plan.

For 1961 we have pledged to produce 4500 t of high-quality pig iron over the plan. Having enlisted in the competition for appropriately celebrating the 22nd Party Congress, the collective of the furnace re-examined their pledges and decided to fulfill them by the opening day of the 22nd Party Congress. The brigades of other furnaces followed the example of the brigade of furnace foreman A. I. Baranov and senior hearth attendant I. D. Amosov.

All members of the furnace collective are studying in circles the history of the Communist Party of the Soviet Union, primary economic courses, and political economics, in schools of the working youth, technical schools, and schools of higher learning.

The collective of our furnace is determined to fulfill their pledges by the opening day of the 22nd Party Congress.

Comrade Shabalov. Steelworker of the No. 2 Open-Hearth Furnace of the Magnitogorsk Metallurgical Combine.

The collective of the No. 2 open-hearth furnace,where I work along with Hero of Socialist Labor M. V. Burkatskii and Mikhail and Dmitrii Kuznetsov,finished 1960 with good indexes. We produced about 7000 t of steel over the plan, reduced rejects by 10%,cold and hot down times were reduced to 5%. Our collective actively participated in the competition for the rank of Shop of Communist Labor. Steelworker D. Kuznetsov transmitted his experience on caring for steel and slag tapping holes to the collectives of other shops. I shared my experience of caring for the furnace and running the thermal conditions of the melt with the young steelmakers. Our services resulted in the shop being awarded the rank of Shop of Communist Labor.

During the first two months of 1961 we have already produced 860 t of steel over the plan, considerably reduced rejects, and completely eliminated accidental breakage.

The collective of our furnace at the beginning of the year pledged to produce over the plan 4000 t of steel, to reduce rejects by 10%, to increase the life to the roof to 500 heats. I wish to say in the name of the entire collective of the No. 2 furnace that with these pledges we will celebrate with honor the 22nd Congress and will fulfill them by the day it opens.

Comrade Sakharov. Chief Engineer of the Cherepovets Metallurgical Plant.

The Cherepovets Metallurgical Plant is an enterprise that is still under construction, and therefore all our shops have the most modernized equipment. In 1960 we put into operation a new, improved sheet-rolling 1700-mill that rolls sheet which is then rolled into coils weighing 5-7 tons. The length of the coiled sheet is 150-200 m.

The operation of the mill is connected with the finishing assembly that finishes up to 1000 t of sheet per day. It is necessary to point out that the rolling-mill specialists of the Cherepovets Plant have successfully mastered the new 1700-mill and the finishing assembly.

The efficient, continuous, billet 700-mill was put into operation this year. Each month of the new year the machinery-building plants of the country receive tens of thousands of tons of billets.

The collective of the open-hearth furnace yearly improves the technical and economic indexes since they have mastered the new technology and equipment. Our open-hearth operators have the highest indexes in the utilization of the volume of open-hearth furnaces and the lowest consumption of coke. This is mainly achieved by a high gas pressure under the top (1.5-1.8 atm) and by the use of a high-temperature blast, 1000-1060°.

The collective of sinter producers mastered the production of highly basic sinter of constant quality, having used for this the new technology of preparing limestone. This became possible after successfully mastering the unit new in metallurgy, the shaft grinding mill.

The entire collective of the plant is now struggling for the high rank of Enterprise of Communist Labor. In honor of the 22nd Party Congress we have undertaken new increased obligations. The results of fulfilling the industrial plan for the first months graphically show that these pledges will be fulfilled with honor by the Cherepovets metallurgists.

Comrade Malyi. Chief Engineer of the Petrovskii Plant.

The Petrovskii Metallurgical Plant has been in existence for 74 years. After the Second World War the plant was restored and there will be no further expansion since 90% of the entire area of the enterprise is occupied by industrial sections. As a consequence of this the production growth will be accomplished by modernization and perfection of the technological processes.

The blast-furnace shop of the plant fulfilled the 1960 plan by 101.6%. The shop should produce still another 1% increase in 1961 against the production already attained. In connection with this, pledges were made to smelt pig iron in excess of the plan. All this will be accomplished by taking the following measures.

An additional, seventh, blast stove will be constructed for the two blast furnaces thus making it possible to raise the temperature of the blast and to make timely repairs of the other blast stoves without lowering the temperature of the blast. In addition to the two blast furnaces that have been converted to automatic control of the blast stoves, another two blast furnaces will be automated. After making capital repairs in April, 1961 on one of the blast furnaces, it was planned to perfect the high-pressure unit which will thus increase the pressure under the top. The casting yards in the area of the slag hole will be serviced by telpher lines. A further improvement in the technology of using natural gas is proposed.

Ingots weighting 4.5 tons, which are subsequently flame cut into two sections, will be introduced in the open-hearth shop along with the introduction of welded steel teeming ladles. This will make it possible to increase the weight of the melt and eliminate bottlenecks in readying the movable cranes for the sheet metal.

Guniting of the roof of the open-hearth furnaces of PSh brick is being introduced, which will increase the life of the furnace.

At the end of the second quarter, a KT-3600 oxygen unit will be put into operation and this will make it possible to use oxygen at all furnaces.

As was done at the Nizhni Tagil Combine the heating conditions in the open-hearth furnaces will be automated. The pouring cranes were a bottleneck in the converter shop which resulted in a stationary stand being put into operation and a second one will be introduced in 1961. Oxygen-flow integrators are being mastered in order to determine the end of blowing the heat. Studies are continuing to perfect cleaning the converter gases.

The construction of a group of soaking pits was completed in May, 1961 in the rail and beam shop, which sharply increases the amount of heated metal. The 3680-kw motor of the blooming mill is being replaced by a more powerful one, 5152-kw. These two main measure will increase the productivity of the blooming mill by 12-15%. The obsolete motor of the breakdown stand of the wire-rod mill will be replaced by a more poweful one. The installation of the ninth reel will facilitate the work of the finishing stand.

Heating of the metal will be improved on the medium-section mill by introducing another reheating furnace; racks for cooling the metal will be doubled in width.

The motor on the plate mill will be replaced by a more powerful one and also rocking tables will be installed. In addition to this, finishing of the sheet will be mechanized, the single-row furnace will be reconstructed to a double-row. All these measures will increase the productive capacity of the mill by 20%.

The pile-driver shop will have sections for flame cutting the scrap that are serviced by bridge cranes, and the construction of the second separator for the preparation of scrap for the blast furnaces is being completed.

The introduction of new techniques, modernization, and improvement of the old equipment result in new tons of high-quality metal and tens of thousands of rubles saved. By the day the 22nd Congress of the Communist Party of the Soviet Union opens the country will receive from the metallurgists of the Petrovskii Plant thousands of tons of metal in excess of the plan.

BLAST-FURNACE OPERATION WITH THE ADDITION OF NATURAL GAS TO THE BLAST

B. N. Starshinov, I. V. Kotel'nikov, V. I. Sinitskii, M. L. Lavrent'ev and V. D. Sinitskii

Ilyich Plant and the Ukrainian Institute of Metals
Translated from Metallurg, No. 7, pp. 4-8, July, 1961

Favorable conditions for the use of natural gas in the blast-furnace have been created by the rapid growth in its production. The use of natural gas not only permits the cost of iron to be lowered, but also decreases the demand for scarce coking coal.

A blast-furnace of the Ilyich plant was the first in the Don basin to be converted to operate with the addition of natural gas to the blast. The gas was fed into the furnace through a flange on the tuyeres. The furnace burden consisted of a mixture of Krivoi Rog iron ores and grade -20 iron ore, sinter from the YuGOK and Enakiev sintering plants, type-4 hearth cinder, and limestone and coke from the Yasinov and Zhdanov KKhZ.

The average iron content of the ores and the sinter from Yu GOK during the periods listed in Tables 1 and 2 and also the quality of the coke varied within narrow limits.

Before converting to operation with natural gas, the blast-furnace produced cast iron for steel manufacture containing 1.10-1.13% Si, 1.90-2.10% Mn, and 0.030-0.050% S, while using an ore load of 2.14 tons/ton of coke and a blast with a temperature of 866° and a moisture content of 30-35 g/m^3.

Three hours before feeding gas into the furnace began, the moisture content of the blast was reduced to the natural level, and the quantity of ore in the charge was increased from 16.6 to 17.24 tons. When gas was supplied (25 May 1959) at the rate of 8000 m^3/hr, the iron was somewhat less hot (the first iron tapped after conversion to gas contained 0.91% Si and 1.86% Mn). Subsequently, the iron became hotter, in spite of the increase in the quantity of ore in the charge to 17.54 tons 1.5 hours after beginning to supply gas and to 17.74 tons during shift III of 25 May. During shift I of 26 May, the quantity of ore charged was increased to 17.94 tons. The heating of the iron continued to increase such that during shifts II and III of 26 May, the silicon content rose to 1.4-1.5%. At this same time, the quantity of ore in the charge was increased to 18.5 tons; the input of manganese ore and limestone was reduced by 0.3 ton each. Since heating of the iron again increased (the silicon content of the iron rose to 2.05-2.29%), an additional 0.3 ton of ore was added to the charge during shift I of 27 May. The maximum charge of ore while supplying gas at the rate of 8000 m^3/hr was 2.54 tons/ton of coke.

Thus, the ore charge was increased by 3.75% by the addition of 1% natural gas to the blast. The amount of feed melted per shift was decreased by 6.1%. The intensity of smelting the ore was increased by 6.4% or by 1.92% for every percent of gas in the blast.

In order to increase the productivity of the furnace, with shift II of 27 May the supply of natural gas was reduced to 7000 m^3/hr, and with shift I of 28 May – to 6000 m^3/hr (2.5% of blast input); the ore charge was correspondingly decreased, since it was thought that while feeding natural gas into the blast-furnace, its increase could not be compensated by the decrease in the quantity of charge melted. To increase the smelting intensity, the moisture content of the blast was increased to 20-30 g/m^3, and the temperature was raised to 950-970°. Under these conditions, there was practically no change in the amount of blast input. As a consequence of these measures, coke consumption rose, but furnace productivity was not increased. Therefore, the supply of natural gas was subsequently increased to 7000 m^3/hr.

In order to analyze the results of blast-furnace smelting with natural gas, particular periods were selected (Table 1) during which the composition of the burden, top pressure, and other technological parameters were recorded. When natural gas was first supplied, the composition of the burden changed: consumption of the YuGOK and Enakiev

TABLE 1

Periods	Length of periods	Blast				Top gas				Pressure drop, atm	Weight of coke charge, tons	Level of the burden, m	System of charging, %			Dust loss at the mouth, kg/ton Fe	Sinter content in iron ore component of the burden
		input, m^3/min	temp. °C	moisture content, g/m^3	input of natural gas, m^3/ton of iron	input, m^3/min	temp. °C	CO_2, %	H_2, %				OOCCC	COOCC	CCOOC		
	1959																
I	I/V—22/V	3843	866	32.0	—	1.35	264	10.7	2.1	1.28	7.0—35% 7.2—45.7% 7.4—18.8%	1.25	20.2	68.5	11.3	53	67.8
II	25/V—31/V	3957	941	20.0	74.8	1.31	274	10.1	2.8	1.33	7.4	1.25	29.4	68.4	2.2	62	60.4
III	1/VI—9/VI	3988	940	27.0	67.6	1.30	269	10.8	2.4	1.35	7.4	1.75	33.6	63.0	3.4	80	59.8
IV	19/VI—2/VII	3852	889	21.0	74.3	1.21	277	10.1	2.4	1.27	7.4	1.25	18.0	76.5	5.5	52	70.3
V	3/VII—25/VII	4055	899	14.4	78.8	1.13	263	11.2	3.3	1.23	7.4	1.25	25.9	72.5	1.6	53	72.2
VI	1/VIII—9/VIII	4139	869	Natural	78.6	1.10	256	11.9	3.3	1.29	7.4	1.25	24.7	75.2	0.1	40	75.5
VII	16/VIII—10/IX	4135	868	Ditto	79.6	1.10	256	11.4	3.4	1.26	7.4	1.25	24.0	74.9	1.1	47	72.0
VIII	13/IX—25/X	4084	823	» »	81.7	1.09	256	10.7	3.2	1.29	7.4	1.75	60.1	37.1	2.8	57	74.0
IX	26/X—4/XII	3999	842	» »	83.5	1.13	229	10.8	3.4	1.33	7.4	1.75	95.4	4.5	0.1	64	74.8
	1960																
X	3/VIII—30/IX	—	857	» »	119.7	1.15	281	11.9	6.8	1.26	7.4	1.75	96.6	3.4	—	77	77.5

sinters decreased from 68% to 60% of the total charge of ore; after the end of June, sinter consumption was increased to 70%, and after the end of July – to 75%, using the sinter from YuGOK. Simultaneously with the increase in the quantity of sinter in the burden, the iron ore mixture was changed to grade-20 ore. The input of manganese ore and hearth cinder was not changed.

The blast-furnace produced cast iron for steel manufacture using slag with a basicity of 1.12-1.16 containing on the average 6-7% Al_2O_3 and 2.0-2.7% MgO during the periods of investigation. After operation with natural gas began, the sulfur content in the iron and slag decreased; this may be explained by the decrease in coke consumption, since the content of sulfur in the coke did not decrease, but during particular periods even increased.

During the II and III periods of operation with the addition of gas, blast input was somewhat increased; the temperature of the blast was increased by 75°, while its moisture content was decreased by 5-12 g/m^3. When the moisture content of the blast was decreased to the natural level (at the beginning of August), the temperature of the blast dropped to 868° (i.e., to the temperature during the period of operation without natural gas) in August and to 823-842° in September-December, 1959.

During operation with natural gas, it was found that the amount of blast could be increased without appreciably lowering its temperature; however, the blower could not deliver this increase when the pressure of the hot blast was 2.6-2.7 atm. Therefore, the top pressure was decreased to 1.10-1.15 atm, permitting a significant increase in the amount of blast with a pressure at the tuyeres of 2.35-2.40 atm.

While operating with natural gas, the level of the burden remained the same, but the coke charge was increased from 7 to 7.4 tons. At the same time, the system of charging was changed: where previously the system of feeding one charge OOCCC and four charges COOCC had been used, at the end of May the furnace began to be loaded according to the system of two charges OOCCC and three charges COOCC. The number of charges with ore forward was increased from 20% to 30% which was, to some extent, conducive to the developement of central gas flow (Fig. 1, curve II). During 1-9 June, the number of charges with ore forward was increased still more (to 33.6%), and the level of the burden dropped to 1.75 m, further promoting the growth of central gas flow with a corresponding decrease in peripheral flow (Fig. 1, curve III). During period IV, after reducing the top pressure to 1.20-1.25 atm and the temperature by 50°, the number of charges with ore forward was also decreased to 18% which led to a reduction in central gas flow analogous to that during period V, when the level of the burden was raised to 1.25 m (Fig. 1, curves IV and V).

Beginning with period VI (August-December, 1959), the temperature of the blast was lowered to an average of 820-870°, the top pressure was reduced to 1.1 atm, moistening of the blast with steam was discontinued, and the

amount of blast was significantly increased. The pressure drop in the furnace was maintained at an average of 1.23-1.30 atm. Beginning with period V, material was loaded into the furnace two thirds of the time according to a charging program where the number of charges OOCCC comprised 1/3 of the total number (charges with ore forward sometimes amounted to 25% during periods V-VII). The distribution of gas flow during this time is shown in Figure 1, curves VI and VII.

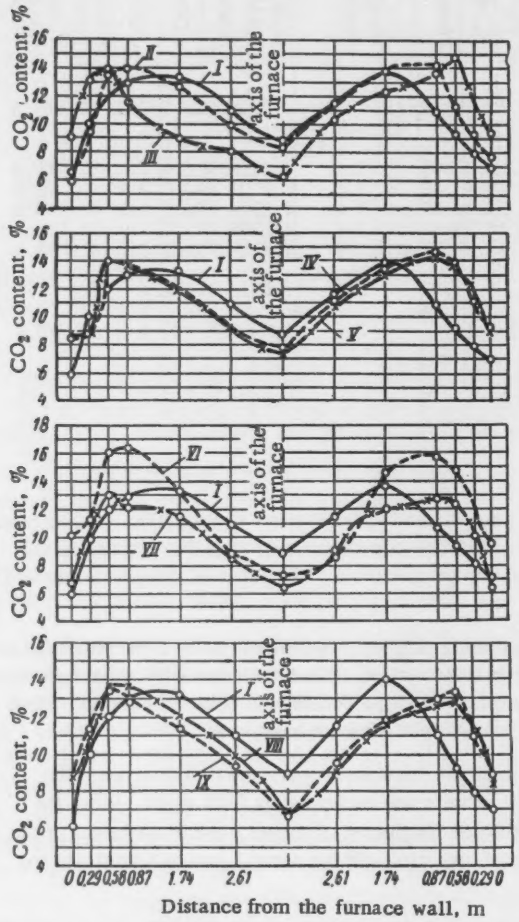

Fig. 1. CO_2 content of the gas along a diameter of the mouth of a blast-furnace in the Ilyich plant while operating with an ordinary blast and with the addition of natural gas. The figures alongside the lines give the period number (Table 1).

At the beginning of period VIII (13-25 October), the level of the burden was lowered to 1.75 m, and the number of charges with ore forward was increased to 60% and then to 95.4% during period IX; this led to a shifting of the crest of the raw materials nearer to the walls (Fig. 1, curves VIII and IX).

Analysis of the distribution of gas flow in the furnace shows that with a nominal lowering of the top pressure, in spite of the increase of the coke charge and the decrease of the moisture content of the blast to the natural level, peripheral flow abated and central flow became more intense when the furnace began to operate with natural gas. This took place even during those periods in which the level of the burden and the number of charges with ore forward remained practically the same.

The chemical composition of the gas-air mixture at the tuyeres indicates that when natural gas is injected into the hearth of the furnace, it begins to burn immediately upon issuing from the flange of the tuyere. At a distance of 100 mm from the flange, the O_2 content was 21% and the CO_2 content – 0.5%; 300 mm from the place of gas injection along the axis of the tuyere, the O_2 content was 20.5% and the CO_2 content – 1.0-1.2%, this being a result of the reaction of the gas with the oxygen of the air. 100 mm further, the O_2 content dropped to 19.5%; but in particular instances it dropped to 11%. The average content of CO_2 and O_2 in the gas issuing from the tuyeres was 3.7% and 17% respectively for the entire period of investigation of the hearth gas composition. Hydrogen, methane, and higher hydrocarbons were not found in the zone of the tuyere. The maximum CO_2 content was observed at a distance of 1.2 m from the tuyere; here, oxygen was absent. At a distance of 1.2 m from the tuyere begins the decomposition of steam, and therefore, a meter and a half from the tuyere the H_2 content of the gas reaches 2%. The oxidizing zone (determined by the CO_2 content) extends 1.6 m from the mouth of the tuyere; but in this zone the burning of coke and decomposition of steam is still not complete, and, therefore, the boundary of the oxidizing zone in the hearth of the furnace lies beyond this point. An analysis of the hearth gas is given in Figure 2.

In the hearth a part of the oxygen of the blast is expended in burning the natural gas. In spite of this, the quantity of gas per unit of blast forming in the hearth is increased. Such changes in furnace operation when natural gas was consumed to the extent of 85 m^3/ton of iron led to a decrease in the intensity of coke combustion from 1.063 to 0.984 tons/m^3 (or by 7.2%). If the combustion of natural gas is considered, however, the intensity of burning carbon remains unchanged.

When the input of gas was increased to 120 m^3/ton of iron and the temperature of the blast increased to 857°, the intensity of coke combustion was decreased by 18.5%, and after converting to summated carbon, coke and gas – by 7.8%.

TABLE 2

Periods	Productivity coefficient per calendar day, m^3/ton	Coke consumption, kg/ton of iron	Intensity of coke combustion, tons/m^3 · 24 hr	Intensity of combustion of carbon from coke & natural gas, tons/m^3·24hr	Ore load, tons/ton of coke	Ore smelted per m^3 of furnace vol., tons/24 hr	Ore and limestone smelted per m^3 of furnace vol., tons/24 hr	Slag output, kg/ton of iron	Iron content in the ore component of the burden no calcine, %
I	0.838	891	1.063	1.063	2.14	2.277	3.030	990	50.16
II	0.811	800	0.986	1.052	2.36	2.327	3.094	965	50.16
III	0.816	825	1.011	1.070	2.34	2.364	3.158	951	50.27
IV	0.819	826	1.009	1.072	2.31	2.328	3.074	894	51.47
V	0.807	803	0.995	1.063	2.42	2.409	3.152	870	51.55
VI	0.805	772	0.959	1.027	2.41	2.307	3.021	878	51.81
VII	0.815	792	0.972	1.040	2.36	2.290	3.005	923	50.63
VIII	0.813	799	0.983	1.054	2.27	2.225	2.973	922	51.48
IX	0.803	798	0.984	1.064	2.26	2.248	3.034	876	52.00
X	0.824	713	0.866	0.980	2.33	2.119	2.560	807	50.72

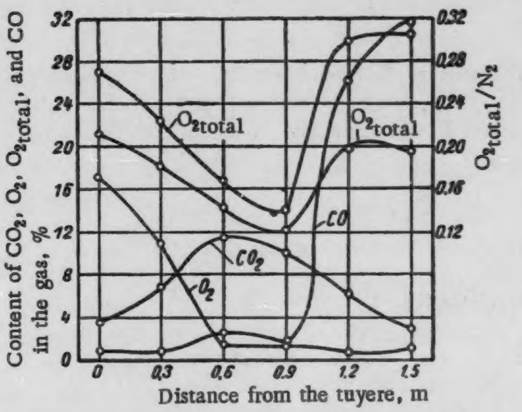

Fig. 2. Composition of gas in the hearth of a blast-furnace at the Ilyich plant in front of tuyere No. 10.

At this time, the ore load was increased from 2.14 to 2.3-2.4 tons/ton. Therefore, the intensity of melting raw materials with a gas consumption of 80 m^3/ton of iron rose somewhat, and the output per 24 hr was increased by 2.5-7.2% (average 4.0%), in spite of the appreciable decrease in top pressure. With a gas consumption of 120 m^3/ton, the intensity of melting ore was decreased by 7%, but the furnace output was increased by 1.7% (per 24 hr).

Replacing carbon from coke with carbon from gas and improving the utilization of the thermal and chemical energy of the gas in the furnace led to a decrease in coke consumption of 7.3-13.4% or an average of 10.2% (Table 2) while consuming gas in the amount of 75-85 m^3/ton of iron; using gas in the amount of 120 m^3/ton of iron reduced coke consumption by an average of 20%.

The results of blast-furnace operation at the Il'ich plant demonstrate the experience of using natural gas even without simultaneously raising the temperature of the blast in order to compensate for the heat used in decomposing the gas.

Experiments with blast-furnace operation at the Pridneprov'e and Stalin plants show that with a simultaneous increase in the temperature of the blast, the effect of using natural gas is greater. Contrary to the surmises of some blast-furnace operators, furnace output not only did not decrease, but rather increased. In all cases when operating with natural gas, the intensity of coke consumption decreases as anticipated by preliminary calculations.

Under the conditions at the Il'ich plant the temperature of the top gas did not increase with conversion to gas as supposed, but rather decreased. Only the increase in gas consumption from 80 to 120 m^3/ton of iron led to a temperature rise of the top gases. Improvement of gas utilization in the furnace required a decrease in the relative quantity of gas, although preliminary estimates indicated that a relative increase was required.

Calculations have shown that every kilogram of carbon brought in by natural gas lowers the consumption of carbon from coke by 0.7 kg. If the utilization of thermal and chemical energy of the gas is improved, consumption of carbon from coke can be decreased by 1.32 kg/kg carbon from gas. At the Il'ich plant this decrease was greater.

Estimates of the economic effectiveness have indicated that using natural gas in the amount of 75-85 m^3/ton of iron under the conditions at the Il'ich plant to produce cast iron for steel manufacture and introducing other means (lowering the moisture content of the blast, working out the optium technological regime for producing iron with natural gas, and so on) have appreciably increased the output of iron at the plant in comparison with the best periods of

operation without natural gas. The saving in coke amounted to 46.7 thousand tons with a consumption of natural gas of 38 million m^3.

With the cost of coke at 209 rubles/ton and natural gas at 11 kopeks /m^3, the savings at the smelting plant amounted to 5.5 million rubles for the time during which natural gas was used in 1959. Increasing gas consumption to 120 m^3/ton and higher permits still greater savings.

The following conclusions can be drawn on the basis of furnace operation with the addition of natural gas to the blast.

Conversion of blast-furnaces to operate with natural gas permits an appreciable increase in the ore load and in the intensity of melting raw materials. The intensity of coke combustion was decreased by 7.2% by blasting with natural gas in the amount of 80 m^3/ton of iron, but the intensity of carbon consumption from both the coke and the gas was almost without change. Furnace output was increase by 4%. Consumption of skip coke was decreased by 10% as a result of replacing carbon from coke with carbon from gas and also increasing the reducing power of the gas in the furnace by the hydrogen introduced in the natural gas.

With a consumption of natural gas of 120 m^3/ton of iron, coke consumption was decreased by 20%; furnace output was increased by 2.1% in comparison with the period of operation without the addition of natural gas.

With the objective of increasing hearth heat and creating a heat reserve for the decomposition of natural gas, loading of the peripheral part of the furnace with ore was made heavier, and conditions were created for intensifying the central flow of gas.

The gas begins to burn immediately upon entering the blast stream. The oxidizing zone (according to CO_2 and O_2) extends from the tuyeres 1.6-1.7 m into the hearth. Steam begins to react with carbon from the coke at a distance of 1.2 m from the tuyeres, and this reaction is not completed within the oxidizing zone (according to CO_2 and O_2).

BLOWING-IN THE BLAST-FURNACE ON FERROMANGANESE

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After an overhaul at the Konstantinov Metallurgical Plant, the blast-furnace was usually blown-in on foundrypig and then switched to smelting ferromanganese. This method is also currently used at other plants. As a result of this, 12-14 days pass before the first smelting of ferromanganese and the attainment of the schedule furnace output; in addition, a great deal of transition iron or scrap is obtained.

The experience of our plant indicates that it is possible to obtain iron of a given composition after one day and reach normal furnace output after 7-8 days by blowing-in the furnace after repair on ferromanganese; moreover, only a small amount of scrap is obtained.

Prior to blowing-in, the furnace had been given an overhaul of II order during which the lining was completely replaced from the level of the tuyeres to the mouth, new guard plates were inserted at the mouth, and a replaceable charging apparatus was installed. Residue of slag and materials was throughly cleaned from the hearth to the level of the iron tap hole.

Before charging the furnace, the tuyeres were shielded with wooden cover plates (the lining of the bosh was not shielded). An iron pipe 100 mm in diameter was inserted into the hearth through the iron tap hole.

The chemical composition of the components of the blow-in burden is given in Table 1.

TABLE 1. Chemical Composition of Blow-In Materials

Materials	Chemical composition, %									
	Fe	SiO_2	Al_2O_3	CaO	MgO	Mn	P	S	losses on ignition	ash
Nikopol' grade I manganese ore	1.76	16.2	3.46	2.0	0.72	44.5	0.253	0.205	12.0	—
Fresh slag	0.22	28.0	11.85	42.47	3.62	9.20	—	1.6	—	—
Limestone	—	0.8	0.60	54.36	0.8	—	—	—	43.2	—
Dolomitic limestone	—	1.0	0.60	40.18	13.25	—	—	—	44.0	
Coke	—	—	—	—	—	—	—	1.75	—	11.5
Coke ash	20.0	36.0	19.3	7.0	1.5	1.0	—	—	—	—

TABLE 2. Characteristics of the Blow-In Burden

Characteristics	Burden number			
	1	2	3	4
Number of charges	20	12	5	20
Coke consumption, tons/ton of ferromanganese	—	3.5	3.0	2.5
Consumption of materials in the charge, kg:				
coke	5400	5400	5400	5400
Nikopol' grade I manganese ore	—	3200	3900	4700
fresh slag	2500*	—	—	—
limestone	—	700	785	900
dolomitic limestone	—	700	785	900
Calculated composition of the pig, %				
Si	—	1.0	1.0	1.0
Mn	—	70	73	73
Calculated composition of the slag, %				
SiO_2	32.2	33.6	32.5	32.6
Al_2O_3	15.2	10.4	9.62	9.3
CaO	38.8	40.2	42.3	42.5
Mgo	3.1	5.9	5.52	5.5
MnO	10.0	10.0	10.0	10.0
CaO : SiO_2 ratio	1.2	1.2	1.3	1.3
Calculated volume of the burden, m^3	246	148	66.5	274.0
Order of the charging	CCCC↓	OLCC ↓	OLCC ↓	OLCC↓
Charge of ore and flux per unit of coke, tons/ton	—	0.850	1.03	1.21
Ore charge per unit of coke, tons/ton	—	0.593	0.735	0.870

*Fresh slag was loaded during the last 10 charges of the first blow-in burden.

The size of the lumps of coke and flux in the burden was respectively 25-80 and 25-100 mm; the tumbling quantity of coke was 340 kg.

The blow-in burden (Table 2) was calculated to obtain ferromanganese containing 1% Si and 70-73% Mn with a slag basicity of 1.2-1.3 and a relative coke consumption of 2.5-3.5 tons per ton of ferromanganese (when blowing-in furnaces on foundry pig, the average coke consumption per ton of pig in the burden at various plants amounted to 3.1-4.12 tons).

The volume of the first blow-in burden was determined from calculations aimed a filling the furnaces two thirds full, i.e. filling the hearth, the bosh, and part of the shaft; estimating a large consumption of heat to reduce the ferromanganese and also to heat the cold furnace lining and the materials charged, the total volume of all the blow-in burdens was calculated to amount to twice the furnace volume.

The input of fresh slag to slag the coke ash did not enter into the calculation of the slag basicity 1.2; this permitted metal sufficiently free of sulfur to be obtained, since an appreciable quantity of it was removed in the gases.

TABLE 3. Characteristics of Furnace Operation during the Blow-In Period

Days of April and months, 1960	Productivity coefficient	Consumption of materials, kg/ton of metal					Parameters of the blast			Slag yield, kg//ton	Dust loss, kg/ton	Temperature of top gas, °C	CO_2 content of top gas, %
		coke	manganese ore	metal additions	limestone	dolomitic limestone	quantity m^3/min	pressure, mm of Hg	temperature, °C				
16	—	—	—	—	—	—	746	700	700	—	434	480	4.1
17	1.14	2840	3440	190	675	550	713	705	768	1800	333	560	—
18	0.989	2280	2670	168	546	446	667	700	833	1475	537	540	5.0
19	0.99	2400	2940	182	678	448	777	735	838	1610	275	530	4.4
20	0.907	2330	2900	201	679	570	798	820	850	1590	354	510	4.0
21	0.844	2110	2390	195	610	402	771	780	851	1285	230	520	2.0
22	0.832	2120	2620	204	600	400	771	830	852	1165	272	500	4.2
23	0.822	2180	2660	256	590	390	771	720	860	1125	274	460	3.0
24	0.709	1810	2240	213	425	348	790	700	857	915	250	540	—
25	0.862	2140	2660	294	492	402	734	620	863	1040	302	530	4
May	0.802	1856	2507	132	478	359	767	0.91	885	1094	128	439	3.5
June	0.805	1831	2521	105	426	332	782	0.88	892	964	213	465	3.2
July	0.812	1907	2654	76	482	347	812	0.86	888	1050	209	465	3.28

and the slag possessed a high desulfurizing capacity as a result of the increased quantity of Mn and MgO in it.

The iron tap hole was easily opened for the first pouring; no difficulty of any kind was found in tapping the metal. Characteristics of furnace operation during the first 10 days after beginning the blow in May and June, 1960 are given in Table 3.

The first slag was tapped 9 hours after beginning the blow, and the first ferromanganese after 15 hours. The metal contained 36.06% Mn and 0.023% S. In the second and third taps the content of manganese was 65.47 and 76.87% respectively with sulfur at 0.017-0.018%. Subsequently, the manganese content in the metal was never lower than 70%.

The silicon content in the ferromanganes of the first tap was 2.6-3.7%; it subsequently decreased and reached the level prescribed by the smelting conditions on the second day after beginning the blow.

The basicity of the slag of the first tap was almost equal to the basicity of the blow-in slags. On the second day after beginning the blow, the basicity decreased in comparison with the calculated analysis due to the higher silica content of the limestone. The basicity of the slag was subsequently increased in order to lower the content of suboxides of manganese in the slag and decrease the loss of manganese.

The increased content of alumina in the slags of the first three days of furnace operation after beginning the blow is due to their enrichment with alumina from the dissolving lining. This is also observed during the first days of furnace operation when blowing-in on foundry pig.

Significant fluctuations in the basicity of the slags during the taps of the first two shifts on April 18 (1.15-1.53) due to inconstancy in the quality of materials led to disruption of smooth furnace operation and a sharp increase in dust losses (up to 1510 kg per charge). In order to eliminate uneven operation, it was necessary to decrease the quantity of blast to 600-700 m^3/min. During the third shift, dust loss was reduced to 815 kg per charge; thereafter, the quantity of blast was increased to normal.

The schedule furnace output was reached on the seventh day after beginning the blow; such a rapid increase in output was not observed when blowing-in a foundry pig.

In the ferromanganese smelted, the content of manganese was over 73% with 0.75-1.14% silicon. The basicity of the slag was 1.56-1.60.

The operation of the furnace during this period is characterized by high output and low coke consumption. The temperature of the blast was held at a level of 885-892°, i.e. at the maximum allowed by the condition of the preheaters.

HEATING THE OPEN-HEARTH FURNACE WITH A MIXTURE OF 'COKE-OVEN AND NATURAL GASES

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After conversion of the open-hearth furnaces at the Makeev Metallurgical Plant to heating with natural gas, there was a surplus of coke-oven gas, a use for which at the plant could not be easily found. At the same time, coke-oven gas, being an expensive and high-calorie fuel, can be used to heat open-hearth furnaces either alone or mixed with other gases. Therefore, three open-hearth furnaces were coverted to heating with a mixture of coke-oven and natural gases.

Heating Plan. Before coverting to heating with a mixture of coke-oven and natural gases, the open-hearth furnaces had operated for almost four months on natural gas alone by a self-carburation system. The furnace was furnished with two pairs of regenerators and a Venturi attachment.

Coke-oven gas was conducted to the furnace through a gas pipe 300 mm in diameter, terminating at the furnace in an injection tuyere (Fig. 1). The design of the injection tuyere permits the utilization of coke-oven gas either alone or mixed with natural gas. There is no diffuser in the injection tuyere, since a reduction in pressure is not necessary.

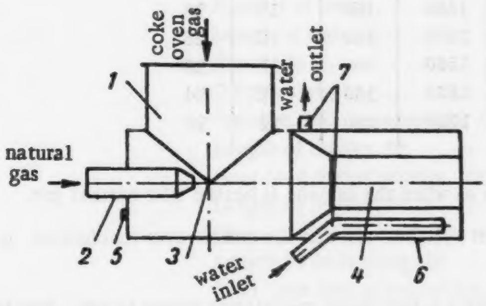

Fig. 1. Injection tuyere. 1) Outlet for coke-oven gas; 2) nozzle for natural gas; 3) collecting chamber for coke-oven gas; 4) mixing chamber; 5) trap valve; 6) water-cooling.

Coke-oven gas enters the gas port of the open-hearth furnace at a rate of 20-30 m/sec which guarantees effective thermal decomposition of the contained methane and separation of the soot. The flame jet of such gas has good luminosity.

When the pressure of the coke-oven gas drops abnormally, and also in other instances when it is technologically necessary to use a mixture of coke-oven and natural gases, natural gas can be injected into the coke-oven gas or fed in separately.

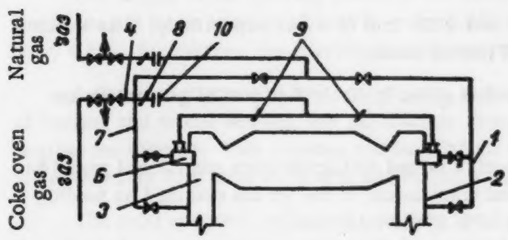

Fig. 2. Schematic diagram of the heating of the furnace by the new process.

In Figure 2 is shown a schematic diagram of the heating of the furnace by the new process. To decompose the hydrocarbons in the natural gas, it is fed through pipe 1 and tuyere 2 into the gas uptake 3 through which enters air, preheated to the reforming temperature of the gas. The coke-oven gas, through pipe 4, regulating throttle 8, reversing throttle 9, and gaging diaphragm 10 enters the injection tuyere 6 which is inserted in the brick of the end of the gas caisson. A part of the natural gas can be fed to tuyere 6 through pipe 7 for injection with the coke-oven gas when the pressure of the latter becomes low.

Reversal of the Flame Jet. Reversal of the flame jet is accomplished with the aid of two elliptic throttles, installed at the inlet of the gas ports and operated simultaneously with the stopcocks for switching over the

TABLE 1.

Characteristics of the Gases

Gas	Content, % by volume											Specific gravity, kg/m^3	Calorific power $kcal/m^3$
	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}	C_nH_m	H_2	CO	CO_2	O_2	N_2		
Natural	64.13	2.89	0.58	0.14	0.96	—	—	—	0.4	—	0.9	0.72	8360
Coke oven	23	—	—	—	—	3.4	60.1	6.7	2	0.6	3.2	0.548	4390

TABLE 2.

The Thermal Regime of the Furnace

Periods of the heat	Fuel consumption			Air consumption	
	coke-oven gas m^3/hr	natural gas m^3/hr	fuel oil kg/hr	primary $\times 10^3$ m^3/hr	secondary $\times 10^3$ m^3/hr
Repairing	1600	1200	–	12	11
Charging	2000	1500	150	12	26
Initial heating	2000	1500	150	12	26
Filling up with pig	1600	1500	–	12	26
Melting	1600	1500	150	12	24
Working	1600	1500	150	12	20

natural gas. The rest of the reversal is done in the same manner as when the furnace is heated with natural gas.

From time to time at the command of a motor relay, gas is switched off, and the switch-over mechanism is simultaneously switched on.

Gas is permitted to be turned on from the opposite side after a safety-drum mechanism ceases to run. The interruption of the flame jet is over in 10 seconds.

Thermal Regime of the Furnace. The open-hearth furnace is heated with a mixture of coke-oven and natural gases to which is added up to 6% fuel oil. The coke oven gas comes to the plant from the Yasinov KKhZ, 100% saturated with moisture and with a sulfur content up to 3.5 g/m^3. The natural gas, consisting of a mixture of gases from the Krasnodar and Stavropol deposits, is dry and contains no harmful admixtures. Characteristics of the gases used are given in Table 1.

The working pressure at the lower and upper tuyeres was 50 and 2000 mm of water respectively. The working pressure of the coke-oven gas at the gas port of the furnace was 50 mm of water.

The thermal regime of the furnace during the melting periods is given in Table 2 (inputs of gas and air are given at 20° and 760 mm of water).

Study of the flame jet in the open-hearth furnace working with a mixed fuel (coke-oven and natural gases) has indicated that the best results from the standpoint of luminosity and temperature of the jet are obtained by feeding coke-oven gas into the gas port in such an amount that it provides 40% of the total heat.

Meanwhile, the distribution of natural gas between the upper and lower tuyeres (according to heat) amounts to 15 and 45% respectively. The optimum input of primary air is 10,000 m^3/hr. In this regard, it is reasonable to consider a correction to the amount of primary air depending on the period.

Judging from the analysis of the waste gases from the rear vertical conduit, the combustion qualities of the fuel when heating the furnace with a mixture of coke-oven and natural gases were practically unchanged as compared with those when heating with a mixture of coke-oven and blast-furnace gases: the temperature of the flame jet during all periods of heating was increased. During the melting period, the average temperature of the jet along the first three openings rose from 1720 to 1775°, and during the working period – from 1780 to 1890°.

The management of the flame jet was noticeably improved. In addition, it was possible to regulate its length to a considerable extent. The temperature of the fumes in the vertical canals during the periods of loading and initial heating was practically unchanged, and during melting and working it was lowered by 50-80°. At this same time, the temperature of the preheated air increased by 100-150°.

Technical-Economical Characteristics of the Use of the New Heating Process

An analysis of the technical-economical characteristics of furnace operation after 289 heats using a mixture of coke-oven and blast-furnace gases and after 303 heats using a mixture of coke-oven and natural gases that the life of the furnace arches of comparable materials was the same and amounted to 170 heats per set of arches. Average characteristics during these heats are given in Table 3.

TABLE 3.
Comparative Data of Furnace Operation Using Coke-Oven Blast-Furnace and Coke-Oven Natural Gas

Characteristics	Coke-oven–blast-furnace gas mixture	Coke-oven–natural gas mixture
Number of heats	289	303
Length of heat, hr	9.64	9
Size of heat, tons	150.85	154.8
Output, tons/hr.	15.67	17.21
Specific fuel consumption, kg/ton	175	163
Length of repairs, hr	0.54	0.44
Heat load during repairs, million kcal/hr. .	15.4	16.9
Length of repairs, hr	2.83	2.48
Heat load while charging, million kcal/hr .	18.8	20.7
Length of preheating, hr	0.99	1.03
Heat load during preheating, million kcal/hr	20.2	20.0
Length of melting, hr	3.03	3.36
Heat load during melting, million kcal/hr .	17.7	19.3
Length of working, hr	1.98	1.41
Heat load during working, million kcal/hr .	18.1	19.3
Length of melting and working, hr	5.01	4.77

The length of the melting period in the furnace while operating with a mixture of coke-oven and natural gases was shortened by an average of 0.64 hr or by 6.6%; the total length of melting and working was shortened by 0.24 hr or by 4.8%. In addition, the specific fuel consumption was also decreased by 12 kg/ton or by 6.86%.

A decrease in specific fuel consumption and a increase in furnace output is observed for all intervals of time of loading and initial heating, but the sharpest increase in output is noted when the periods of loading and initial heating are shortest. This increase can be attributed to the increased weight of the charge, since the length of melting is shortened by 0.49 hr or by 2.24% and output increases by 1.5 tons/hr or by 8.6%.

The total economic effect of coverting the furnace to operate with high-calorie fuel according to the process described above amounts to a saving of 60 thousand rubles per year under the conditions at the Makeev plant.

CONCLUSIONS

1. Utilization of a mixture of coke-oven and natural gases for heating open-hearth furnaces affords a use for the surplus of coke-oven gas which is created by converting furnaces to natural gas.

2. By the new heating process, the length of melting can be shortened by 6.6%, the length of melting and working – by 4.8%, and fuel consumption is reduced by 6.86% in comparison to heating the furnace with a mixture of coke-oven and blast-furnace gases.

3. Appreciable capital expenditure and shutdown of the furnace are not required in order to convert the open-hearth furnace to the new heating process.

HYDRAULIC CONTROL OF STEEL LADLE STOPPER MECHANISM

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The hydraulic apparatus employed at the Kursk Metallurgical Combine serves for the simultaneous control of the two stoppers mounted on steel ladles of a capacity exceeding 200 tons.

The hydraulic machine is mounted on a special platform on the first floor of the control cabin of each ladle crane having a lifting capacity of 280/50/15 tons. The stopper mechanisms have been modified on all the ladles to enable hydraulic cylinders to be coupled to them when pouring. Pouring by means of hydraulic machines is a practical possibility, any available ladle cranes and any ladles being used.

The machines operate reliably. Provision is made for changing over any stopper to manual control, this being necessary when a stopper is fitted before steel is run into the ladle to check the accuracy of closure of the nozzle orifice, as well as in the event of accidental closure of the stopper or failure of the hydraulic or electric control.

The hydraulic apparatus (Fig. 1) consists of the following main units: oil tank 1 forming the base of the machine; high-pressure rotary pump 2 type L1F12 with motor type PNV28.5, power 1.6 kw, speed 1000 r.p.m.; two valve blocks 3 mounted on the top of the tank with electromagnetically controlled valves; safety or overflow valve 4 type G52-13, mounted on the upper cover of the tank; emergency air-valve 5 (also on the tank cover); nitrogen cylinder 6 with control wheel 7 for controlling it from the cabin; two working hydraulic cylinders 8 connected to the ladle stopper mechanisms before pouring, and a folding common push-button electrical control desk for both stoppers (not shown in the diagram). The tank contains an electrical heater for heating the oil. An electrical control panel is accommodated in a closed box on the hydraulic machine.

The oil is drawn by the pump through a filter and fed to the safety valve, which is set for a pressure of 40 atm. Complete immersion of the pump in the oil improves its working conditions. A pressure gage is mounted after the valve to enable the pressure of the oil to be observed and also to indicate whether the apparatus is functioning properly. The safety valve, which is fitted with an overflow piston of differential type, requires systematic attention and inspection, since penetration of dirt between the parts of the piston results in corrosion and failure of the valve. Normally, when the pump is working and no oil is being delivered to the working cylinders, the valve maintains a pressure of 40 - 45 atm. Delivery of oil to one cylinder reduces the pressure to 25 - 30 atm and when both cylinders are working simultaneously, the pressure should be maintained at a value not less than 20 atm.

The construction of the valve is complicated and is currently being improved with the object of simplification and increasing its working capacity. The oil is delivered through the main distributing pipe (shown in heavy lines in the diagram) to the reversing valves c of both valve blocks. When the apparatus is working normally, the valves are fully raised to the top position. In the event of emergency change over to manual control of the stoppers or one of

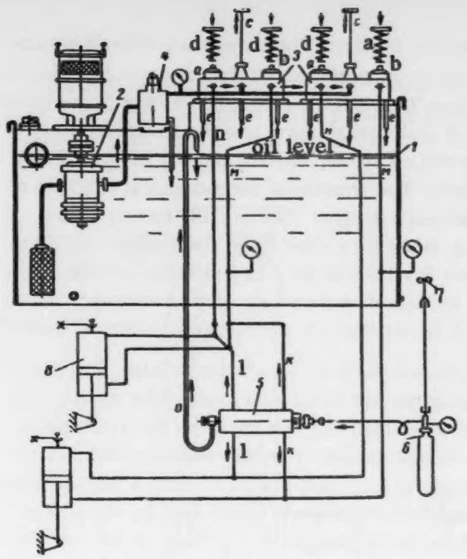

Fig. 1. Diagram of stopper control apparatus.

the stoppers, it is merely necessary to lower the corresponding reversing valve and fit a manual control handle on the shank of the stopper mechanism.

Each valve block has a piston valve a for raising the stopper, and a piston valve b for lowering the stopper. The valves are set in operation by the teemer pressing the corresponding push-button on the portable control desk.

When the control push-button for raising the right-hand stopper is pressed, for example, current flows in the winding d corresponding to this valve. The armature of the winding descends and presses on the valve which, in descending, allows oil to pass along the pipe n into the upper chamber of the working cylinder. The latter together with the stopper mechanism moves upwardly and the oil from the lower chamber of the cylinder passes along the pipe m through the valve b into the oil tank

If the stopper has to be closed rapidly (due to fracture of the stopper rod head, power failure in the mains, valve corrosion or failure of the safety valve), an emergency valve is brought into operation by means of

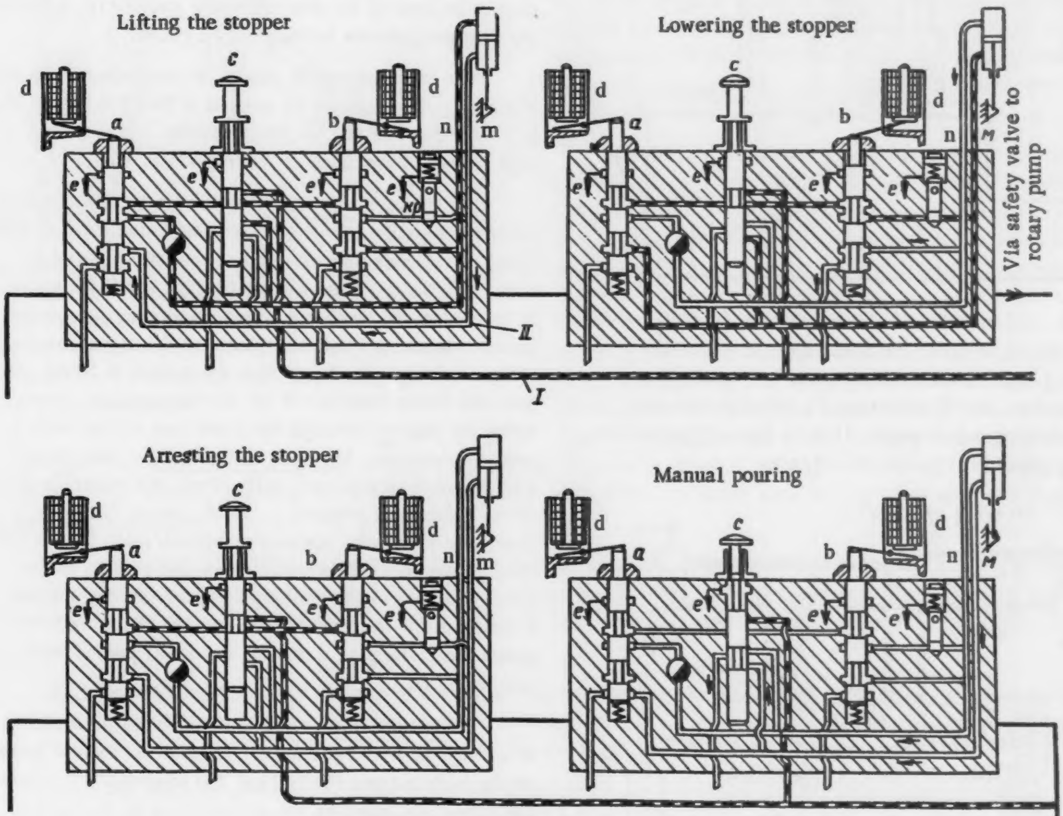

Fig. 2. Diagram to show operation of valve block. 1) Oil pipeline under pressure from the pump; 2) free discharge of oil.

compressed nitrogen supplied by the cylinder 6 at a pressure of not less than 60 atm. The emergency valve is permanently connected to the pipes n and m of both working cylinders. In any position of the cylinders and piston valves of the valve blocks, opening of the cylinder 6 by means of the control wheel 7 ensures the supply of nitrogen at a pressure of 60 atm through the emergency valve along the pipes k to the pipes m and through them into the lower chambers of the working cylinders. The oil in the upper chambers of the cylinders will escape through the pipes n and l to the emergency valve 5 and through the latter to the pipe o and into the tank. The pressure of the nitrogen is sufficent to close both stoppers instantly and to produce a pressure of up to 2 tons on each stopper. The working system of the emergency valve is tested every 24 hours. The emergency valve being in use for a short time, the nitrogen supply in the cylinder is sufficient for 4 or 5 reliable closures of the stoppers. Instead of repeated use of the emergency valve, however, it is customary to change over to manual control.

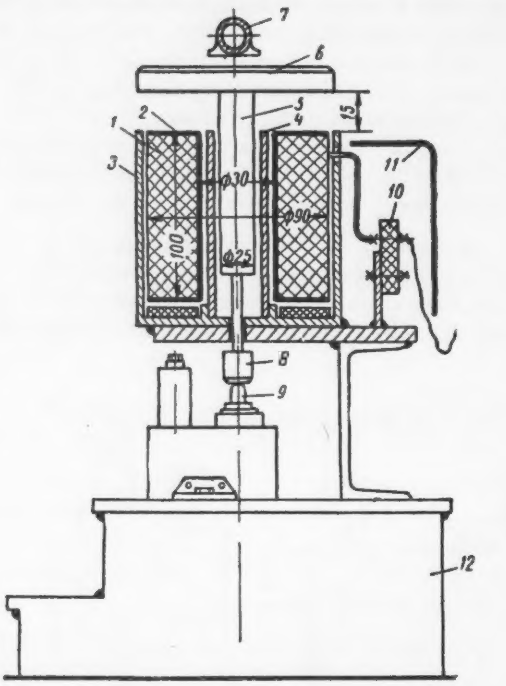

Fig. 3. Construction of electromagnets. 1) Coil, wire PE-0.35, 15,500w; 2) presspahn casing; 3) tubular housing, wall thickness 5 - 6 mm; 4) bronze sleeve; 5) armature rod; 6) armature; 7) common armature stop; 8) copper end-piece; 9) valve head; 10) common supply panel; 11) guard; 12) oil tank.

In practice, such an occurrence is fairly infrequent. The cylinders remain filled with nitrogen for month, but independently of this, they are removed for check every 3 months, beingreplaced by freshly-filled cylinders with tested pressure gage. They are filled from a large-capacity cylinder supplied to the open-hearth shop by the oxygen station. After being charged to a pressure of 60 atm, the cylinder is immersed in water until the top of the valve is submerged. The cylinder is regarded as suitable if there is no leakage of nitrogen in the course of 5 - 10 min. The cylinder valve has been modified so that the pressure gage is in front of the shut-off valve and always indicates the nitrogen pressure in the closed cylinder.

The most important part of the apparatus is the valve block (Fig. 2), designed by workers of No. 2 machine shop I. I. Chuvikovskii and M. M. Vashchuk, and requiring a high degree of precision in its production.

For lifting a stopper, oil under pressure flows along the main pipeline, the main reversing valve c being fully lifted, and passes through ducts to the valves a and b. Under the action of the solenoid d (left hand) the valve a is lowered by 15 mm, and allows oil to pass through the pressure-limiting valve and pipe n to the upper chamber of the working cylinder, so that the stopper is lifted. Oil from the lower chamber of the working cylinder passes along the pipe m, through the lower part of the valve a and into the tank. Lowering of the stopper also occurs with the reversing valve c fully lifted, but under the action of the right-hand solenoid d, which presses the valve b downwardly, thereby opening communication for the oil through the pressure-limiting valve and pipe m to the lower chamber of the working cylinder. As the stopper is lowered, oil from the upper chamber of the cylinder passes along the pipe n through the lower part of valve b into the tank.

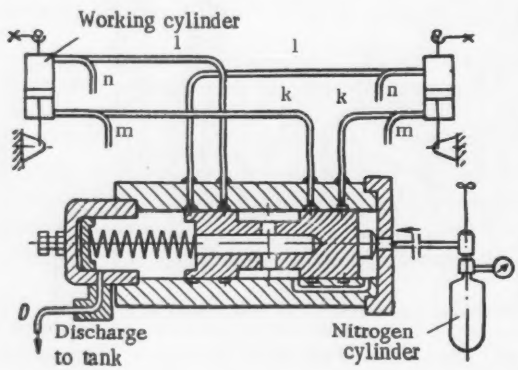

Fig. 4. Emergency valve.

Arrestment of the stopper occurs with the main reversing valve c in the upper position. As soon as pressure on the push-buttons controlling the solenoids d is released, the valves are lifted by the action of return springs and shut off the oil supply to the respective working cylinder. By short-time operation of the control push-buttons, it is quite easy to move the stopper slightly and so regulate the flow of steel.

For manual pouring, the main reversing valve c is lowered as far as it will go, thereby cutting off admission of high-pressure oil to the ducts. The pipelines m and n are connected together and to the oil-discharge duct leading to the tank, so that the oil can pass freely from both cylinder chambers and does not interfere with the manual control. The arrows e indicate the drainage of oil from the glands and its discharge to the tank.

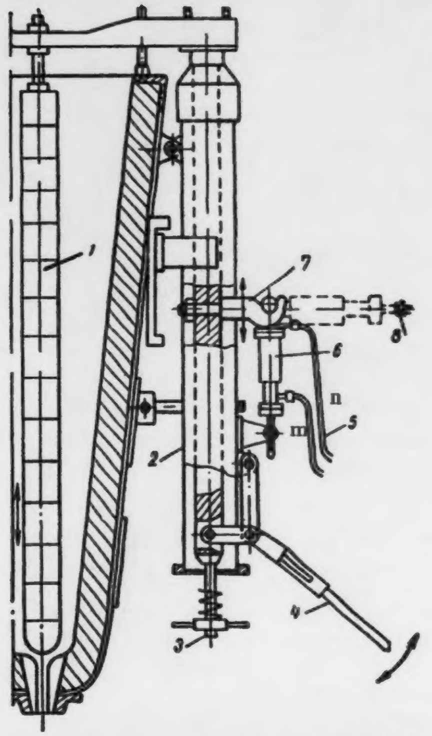

Fig. 5. Method of mounting the working cylinder on the ladle stopper mechanism: 1) Stopper; 2) barrel; 3) mechanism rod; 4) shank and handle for manual control; 5) high-pressure flexible tubing (oil supply and discharge); 6) working cylinder; 7) hook; 8) position when mounting.

In practice, change-over to manual control of the stoppers takes place as follows: The crane driver, who has the handwheel of the nitrogen cylinder valve within reach, is given the order "Open emergency valve." The stopper is immediately lowered and the flow of steel is cut off. After the order "Change over to manual," the crane driver approaches the machine, lowers the reversing valves c as far as they will go and switches off the electric supply to the apparatus. At the same time, the teemers fit handles to the stopper mechanisms for manual control of the stoppers.

Figure 3 shows the construction of the electromagnets made by the Kursk Metallurgical Combine, which have proved reliable in operation, and the method of mounting them on the valve blocks (this construction has replaced the brake magnets shown in Fig. 2). On operation of the control desk push button, current flows through the coil, the armature is attracted and moves the valve downward. When the current to the coil is cut off, the armature rod is lifted by the valve spring.

Figure 4 shows the emergency valve. When the nitrogen cylinder valve is opened, nitrogen immediately enters the right-hand chamber of the valve and moves the piston as far as possible to the left, compressing the return spring. At the same time, nitrogen escapes from the right-hand chamber into the pipe k and to the lower chambers of the working cylinders; a groove in the valve piston allows oil from the upper chambers of the working cylinders to escape through the bore in the piston into the pipe for discharge to the tank. The use of nitrogen does not introduce any complication in the working of the oil system; on the apparatus being changed over to normal working, the nitrogen is expelled from the system in 3 - 5 strokes of the piston of the working cylinder, for which purpose a few idle strokes are made with the cylinders removed from the stopper mechanisms.

The working cylinders (Fig. 5) for the steel ladle stopper mechanism are usually kept on the crane. For mounting on the stopper mechanism before pouring, the cylinder is engaged in the horizontal position in the jaw of the hook and is lowered into the vertical position until the orifice in the eye of the rod coincides with the orifice in the stopper barrel bracket.

The hydraulic apparatus and the nitrogen cylinder are accommodated on the crane, not in the driver's cabin but on a platform alongside the cabin, which does not interfere with entry into the cabin, while the apparatus is always accessible to the crane driver and fitter who supervises the machine and adjusts it while it is in service.

Above the machine is a control panel which has 4 contactors for switching on the valve electromagnets, a contactor for starting the motor, a switch for the 25 amp oil heater, fuses and a knife switch. In addition, the main switch of the machine is accommodated in the crane driver's cabin.

By means of the apparatus described, it is the intention to pour steel without the assistance of a teemer so that control will be carried out by the driver of the ladle crane. For this purpose, he must see the filling of the ingot and bring the crane exactly over the mold center. The second problem has already been solved by means of an apparatus which records the position of the mods on a magnetic tape, but the problem of the driver observing the stream of metal has not yet been solved. Currently, pouring control is effected by a teemer using push-buttons on a portable panel.

EXPERIENCE IN THE CAMPAIGN TO REDUCE THE COST OF STEEL

(READ AT THE CONFERENCE OF METALLURGISTS OF THE CHELYABINSK COUNCIL OF PEOPLE'S COMMISSARS)

S. S. Zubkov

Foreman of No. 2 electric steel-melting shop at the Zlatoust Metallurgical Plant.
Translated from Metallurg, No. 7,
pp. 17-19, July, 1961

The collective of our shop achieved considerable success in 1960. Thus the output for the year was 9014 tons over and above the plan, and a saving of 636.2 thousand rubles was effected through the reduction in the cost of steel.

Increase in the productivity of labor. One of the principal factors in increasing the productivity of labor is the reduction in the duration of a heat, which can be done with good production organization, i.e. by reducing the length of stoppages between heats. In 1959, they amounted to 15.1% and in 1960 to 10.0%; the duration of a heat reached 4 hours with an average shop value of 4 hr 15 min.

Rapid, high-quality cleaning and repairing of the furnace enables melting to be carried out more intensely, and the transformer power to be used to the maximum extent.

Our aim is to carry out the technical operations of a heat at the lower limits, in the minimum time permitted by the technical instructions. Thus, currently, the boiling and refining periods are 33 min and 1 hr 29 min; previously they were 42 min and 1 hr 40 min.

Due to the higher quality of the repair work of the furnaces, the selection of rational electrical and thermal working conditions and the increase in the skill of the steel melters, the life of the furnace linings and roofs has been considerably increased; in 1954 it was 126 heats for the walls and 160.5 for the roofs, while in 1959 it was respectively 70.6 and 103 heats.

Economy in alloying and refractory materials. In response to the appeal of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers "On the economy of ferrous and nonferrous metals," the collective of the shop conducted a metals economy campaign (nickel, ferromolybdenum, ferrovanadium, ferrotungsten, ferrochrome), which assisted considerably in reducing the cost of the steel.

The consumption of alloying metals is planned on the mean limits of the given element. Consequently, the production of steel with a content of valuable elements at the lower limits will result in a considerable economy in ferroalloys. In this connection a record has been started in the shop of the work of the foremen in keeping within the limits of the chemical analysis in regard to the content of valuable elements. For example, in melting steel R 18, the average shop consumption is 1.30% for vanadium and 18.2% for tungsten, the section figures being respectively 1.21 and 17.8%.

In 1960, the shop effected a saving in nickel of 106.8 tons, ferrochrome 496.5 tons, ferrovanadium 5.4 tons and ferrotungsten 99.2 tons.

The shop has achieved a considerable reduction in costs by economies in magnesite powder. Thus, while in 1959 the consumption of this material was 52.1 kg per ton of steel, in 1960 it was reduced to 49.0 kg. This was achieved by organizing at the plant a competition to economize in magnesite powder.

At the suggestion of senior foreman Sidorov, a start has been made with lining the walls with chrome-magnesite brick using an acid mortar; so far, the life of the walls has been increased to 240 heats; in addition, the steel melters have considerably improved the care of the furnaces.

Much attention is devoted at the shop to the use of magnesite-chromite, magnesite and chrome-magnesite bottoms.

It must be said that the results in regard to economies in magnesite powder and increasing the furnace life would be still better if the plant were supplied with high-grade magnesite powder.

Discarded material. The amount of discard in the shop is still high. This is primarily due to the fact that more than half the workers in the shop are young steel melters and foremen who are not yet sufficiently experienced. Currently, the shop is producing a new range of steels. In 1960, the average amount of discard for the shop was 1.58%, and the discard per section was 1.10%.

It is time that the Chelyabinsk Council of People's Commissars decided the question of foremen working on two furnaces, as is done at other plants when working on a complex range of steels. The foreman has to weigh the charges and ferroalloys and see to the organization of production, and very little time is left for supervising the heat, which, of course, affects the quality of the steel. It will undoubtedly pay to employ a foreman on only two furnaces, due to the reduction in discard and the increase in output.

Utilization of waste material. The plant receives a large quantity of high-alloy turnings of the type Kh20N80, R18, etc., strongly impregnated with oil; it is therefore difficult to use this material in the shops and only small quantities are consumed. To increase the consumption of these turnings, the Glavvtormet * and the producing plants must be induced to burn off the oil on the spot, or to allocate the equipment and means for erecting a furnace for this purpose at the plant. This lightweight waste arriving at the plant cannot be charged into the furnaces in large quantities on account of its bulk, and a press should therefore be provided for baling it. These steps would result in the production of larger amounts of valuable alloying elements from this waste material.

Electric power economy. A campaign for saving electric power has been organized in the shop. In 1959, the steel melted per 1000 kva was 8.3 tons per section and in 1960, 10.25 tons were actually melted for an average shop figure of 9.79 tons.

In the campaign for reducing the cost of steel, a considerable part has been played by the initiative of steel melter Petrakov, who suggested that the matter involved should be a collective responsibility. A single complex crew was formed at the furnace, the pay was correspondingly varied, being no longer determined by the work of an individual shift, but by 24 hour indices of the unit as a whole. Such organization of labor has improved the care of equipment, and the relations between the members of the collective have become truly communistic.

The technical and economic working indices have also become different. Thus, in comparison with the same period in 1959, the output of the furnace per 24 hours has increased by 5 tons, and the duration of a heat has been reduced by 45 min. The furnace collective accomplished the annual plan in good time by the 5th November, 1960 and saved 883 thousand kw-hr of electric power. In October, 1960, the furnace collective was given the title of communist labor collective.

The study and dissemination of our experience in the campaigh for reducing the cost of steel by other metallurgical plants will undoubtedly help in considerably reducing the cost of the marketable product.

* Main Administration for Production and Processing of Ferrous and Nonferous Metals and for Marketing Scrap Metal.

FOUR-STEP BRICK LINING OF STEEL LADLES

L. I. Kovalenko

From an Information Leaflet of the Central Office of Economic Information of the Stalinks Council of People's Economy.
Translated from Metallurg, No. 7, p. 19, July, 1961

The open-hearth shop of the "Azovstal'" plant uses 180 - 200 ton steel ladles.

The working part of their lining was made as follows: 20 lower rings from the bottom were made of ladle brick KP-12 (All-Union State Standard 5341 - 50), 150 mm thick, the remainder of the lining was made of brick KP-11, thickness 115 mm.

With such a lining, the ladles became unserviceable after every 10 - 12 heats due to the burning of the lining of the lower zone to a thickness of 40 - 50 mm, although the upper part of the lining still remained in satisfactory condition with a thickness of 80 - 100 mm.

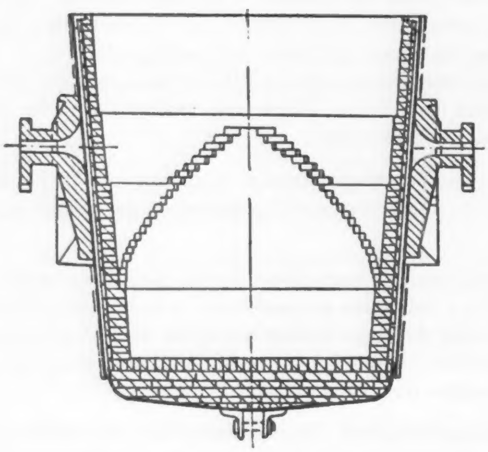

Diagram of ladle lining.

On the suggestion of workers of the open-hearth shop P. I. Emel'yanenko, A. D. Matsakov, N. A. Zhdanov and M. R. Medvinskii, a four-step brickwork lining of the steel ladles was introduced from September, 1959.

By the new method, the lining is made in the following sequence (figure). The bottom zone to a height of ten rows is made of ladle brick KM-14 (All-Union State Standard 5341 - 58), thickness 200 mm, the second zone of 15 rows of brick KM-12 and KM-13, thickness 150 mm, the third zone (from the ladle bottom) in 10 rows of brick KM-10 thickness 120 mm and the fourth (top) zone of brick KM-7 thickness 100 mm.

The adoption of this proposal resulted in the life of the lining of the ladles being increased to 20 heats, the consumption of ladle brick per ton of steel was reduced to 0.8 kg, and the annual saving amounted to 50 thousand rubles.

ROLLING LIGHT-WEIGHT SECTIONS ON THE 550-MILL

E. A. Demidovich, Chief of the Rolling Laboratory of the Central Plant Laboratory
and N. I. Pindyurin, Senior Roll-Groove Designer, Enakievo Metallurgical Plant

Translated from Metallurg, No. 7,
pp. 20-22, July, 1961

The 550-merchant mill of the Enakiev Metallurgical Plant consists of three-high stands arranged in a single line. They are driven by a 1000-horsepower, 90-100 rpm steam engine. A 45-ton flywheel is placed between the pinion housing and the steam engine. All roll stands are equipped with lift tables on the rear end. Tilting plates are installed at the front end of the roughing mill for tilting the blooms or slabs. The bloom or slab from the roughing stand is delivered to the planishing stand and from the planishing to the finishing stand by two independently operating chain transfers.

The collective encountered a number of difficulties when changing over to rolling lightened sections. The difference in the dimensions of the new sections from those ordinarily rolled on the mill was mainly the decrease in the thickness of the walls and flanges and width of the webs (Table).

Dimensions of Light-Weight and Normal Shapes

Shape	Type of shape	Wt of running meter, kg	Thickness of wall, mm	Thickness of flange, mm	Width of web, mm	Inside taper of flanges, %	Drag torque, cm^3
Channel No. 10	Normal	10.0	5.3	8.5	48.0	10.0	39.7
	Light-weight	8.59	4.5	7.6	46.0	10.0	34.8
Channel No. 12	Normal	12.06	5.5	9.0	53.0	10.0	57.7
	Light-weight	10.4	4.8	7.8	52.0	10.0	50.6
Beam No. 12	Normal	14.0	5.0	8.4	14.0	16.7	12.7
	Light-weight	11.5	4.8	7.3	64.0	12.0	58.4

The roughing stand was common when rolling No. 12 beams and No. 10 and 12 channels according to the All-Union State Standard. The starting square of 170 × 1400 mm was reduced in eight passes to the shape for No. 12 beams and No. 12 channel, and the square of 150 × 1500 mm was reduced in four passes to a rectangle for No. 10 channels. Four passes were made to produce these sections on the intermediate stand and three passes on the finishing stand. The groove design for the No. 12 beam according to the old State Standard provided good rolling conditions. The shape was produced with an even web and with tapers of the closed flanges of 3% and of the open flanges 5%. The taper of the closed and open flanges was 1% on the finishing groove.

In the straight roll-pass design for channels which is used on the mill (Fig. 1a) the drawing passes were uneven (Fig. 2, curve a), but this pass design assured a reduction in the difference of thickness of the flanges during axial shifts of the rolls. The inadequate rigidity of the axle attachment of the roll stands made it impossible by adjustment to achieve symmetry of the flanges in thickness, therefore the actual flanges of all grooves of the finishing stand (on the side free from the spindles) were bored out thinner by 0.3 mm.

The small tapers of the flanges (5-3%) caused rapid wear of the grooves and made the work of the guides worse.

To roll light-weight channels we used a system of pass designs having a groove taper of the flanges of 10% in all grooves except the finishing, where this taper was increased to 1.5% (Fig. 1b). The planishing mill was made

half-closed with a groove taper of the flanges of 10%. Reductions in the intermediate stand are now distributed uniformly (Fig. 2, curve b).

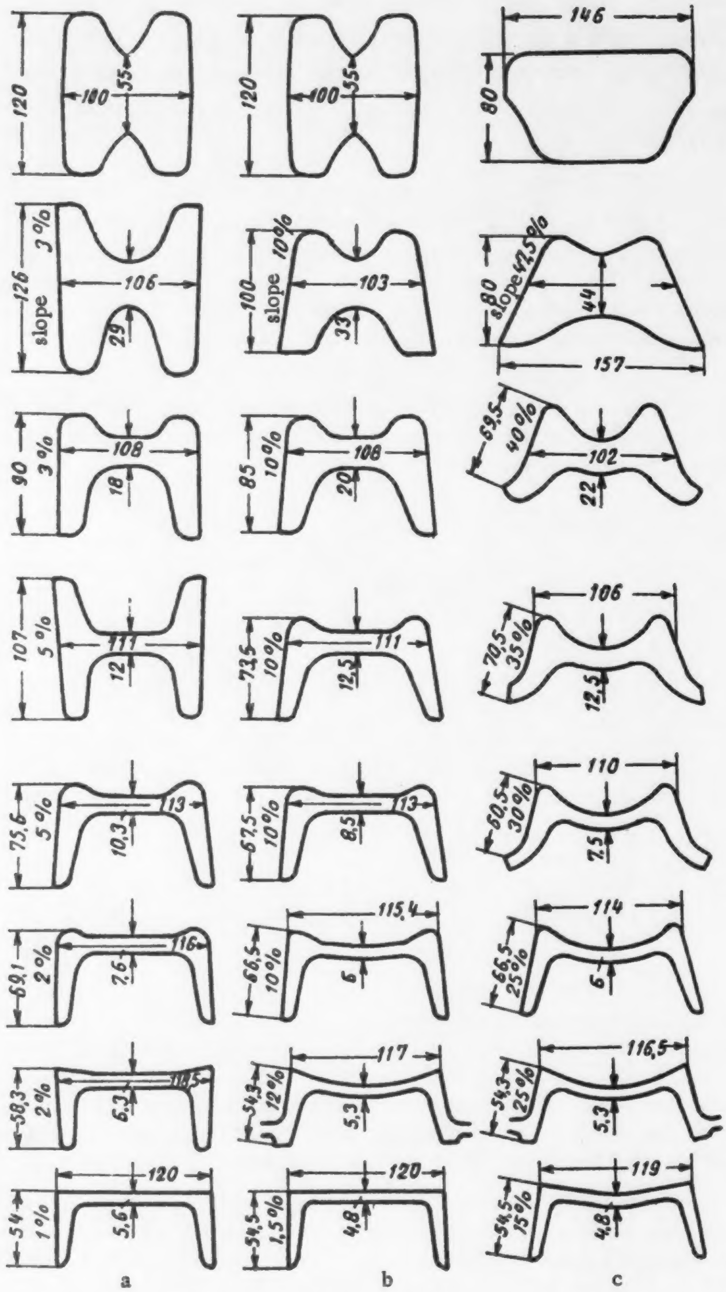

Fig. 1. Pass design for No. 12 channel: a) Old; b) new (lightened channel); c) being introduced into production.

To roll the light-weight No. 12 beam we selected a groove design with a bend in the web and turned the open and closed flanges 10% on the intermediate stand and 5% on the finishing stand while keeping the angle between the flange and the web 90°. The finishing groove was left with a taper of the flanges of 1.5% and with a straight web. This groove design has worked out well at the Kuznetsk Metallurgical Combine and did not cause special complications during experimental rolling on the 550-mill.

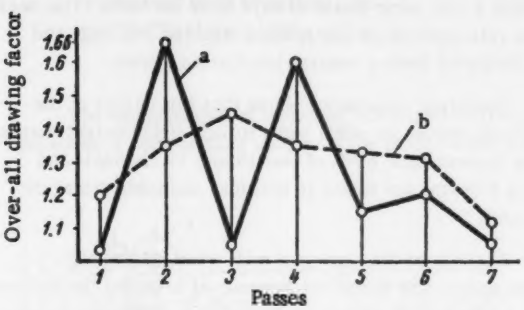

Fig. 2. Over-all drawing factors of the pass design for the No. 12 channel: a) Normal; b) lightened.

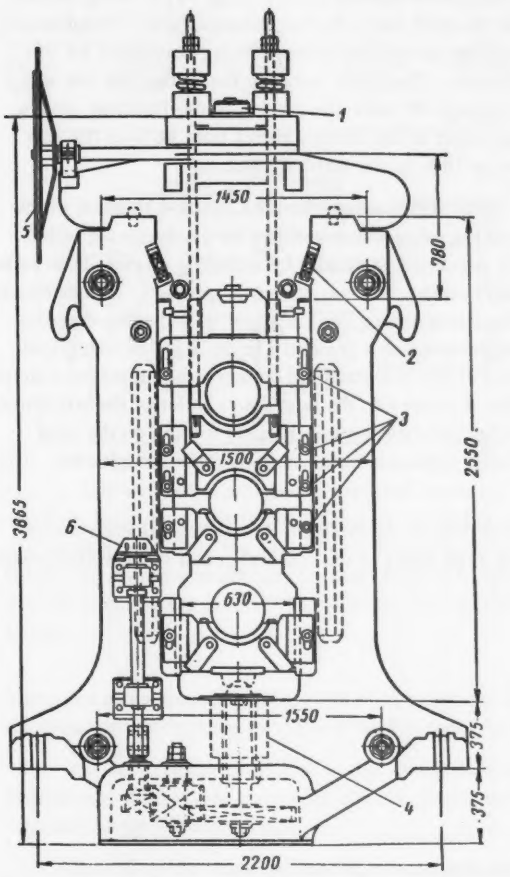

Fig. 3. New frame of roll stand: 1) Screwdown gear of upper roll; 2) cotter fastening of the cover; 3) bolts of the axial displacement; 4) screwdown gear of the lower roll; 5) steering wheel of the upper screwdown gear; 6) steering wheel of the lower screwdown gear.

The experimental rolling of channels showed that the use of the new groove design on the frames of the old structures is associated with many difficulties: to produce the nominal thickness of the web it was necessary to operate "shaft to shaft." In addition, this operating method was due to the considerable elastic deformations of the frames of the roll stands and the rolling rolls, which led to large impacts on the mill as the rolles product issued from the grooves; there were also cases of roll breakages and twisting of the wobblers.

Correct axial alignment of the rolls is important for obtaining a satisfactory symmetry of the shape. In cases when the rolls were relatively free in an axial direction (the clearances on the extreme collars were not regulated), the rolled product passes unsatisfactorily due to the lack of symmetry along the thickness of the flanges. Side bolts did not hold down the rolls since the heads of the bolts were broken off. A satisfactory shape was obtained by boring the rolls with minimum clearances on the extreme collars, but in this case the tapers of the collars were severely worn out and could not be restored at the time of reconditioning. The symmetry of the shape at the time of rolling deteriorated due to the clearances. For restoring the symmetry by axial adjustment we were forced to use special gaskets which were placed between the spindles and the rolls in the coupling boxes. But even this did not provide stability during operation. New, more rigid rolling stands were needed.

In March,1960 the first stage in reconstructing the mill was accomplished: the heating power of the reheating furnace was increased by intensifying the bottom heating, new roll stands were installed and the spindles balanced. A new bed under the rolling mill was made taking into account the replacement of the steam engine by two electric motors (for the break-down and roughing stands with 100 rpm, and for the finishing stand with 125-150 rpm).

The new roll stands (Fig. 3) designed by the plant have considerable advantages in comparison with the old ones whose main shertcoming (besides the small rigidity) was that the lower roll could not be regulated. To decrease the "iron" between the lower and middle rolls required lowering the middle and upper rolls simultaneously, for which the senior roll operator had to tighten 12 regulating bolts, which was physically difficult and time consuming. The middle roll was made nonadjustable in the new stands. The rigidity of the stands was increased by cottering the covers which was done so that the pressure of the metal on them is transmitted directly through the cotters. The advantage of such a fastening is that it cuts down the number

of connections between the cover and the frame, which helps to reduce the deflection of the rolls under a load and to increase the accuracy of rolling. The upper chock of the middle roll is fastened by cotters transmitting the force to the covers of the frames and by adjustable bolts fastened in the slots of the cover. The screwdown gear of the upper roll is made with a primary transmission and a hand drive operated from the working platform of the mill by a steering wheel. The transmission of the lower screwdown mechanism includes a cast cone and is always in an oil bath. The necks of the rolls operate on all-pressed textolite bushings and are lubricated from a central lubrication system.

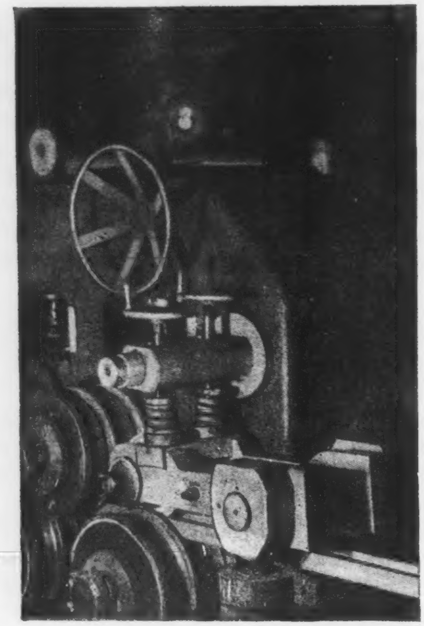
Fig. 4. General view of the straightening device.

Operating experience shows that this design of the roll stands proves its worth when rolling light-weight shapes. At the present time 80% of No. 10 and 12 channels and No. 12 I-beams are rolled to nominal and subnominal dimensions.

The life of the cast-iron rolls when rolling light-weight shapes was shortened because of lowering the temperature at the end of rolling by 20-30° (the difference between the temperature of the web and flanges reaches to 80°).

Presently a groove design for channels with the finishing groove opened to 15% (Fig. 1c) is being worked out for the mill and a further, more accurate straightening of the shape in the cold state is being developed for the straightener. The angle between the flange and the web is being kept 90° from the cutting to the finishing groove, and the taper of the flanges varies from 45% in the first groove to 15% in the finishing groove.

A special machine that is a massive stand in which are fastened two-column-and-knee straightening rollers one above the other was developed by the designing office for better straightening of cold channels. The upper roller can be regulated vertically by adjusting screws. Both rollers are driven by an ac electric motor through a reducing gear, pinion housing, and two universal spindles. To synchronize the delivery speed of the metal with the speed of the rollers of the straightening device a special adjusting coupling is provided. The straightening device is installed behind the straightener and is presently in the stage of being built. G. P. Chernyshev, efficiency expert of the shop and senior foreman of the rail-finishing department, suggested a simpler device (Fig. 4) consisting of a roller fastened on special levers that is pressed to the next lower roller of the straightener by two springs which are regulated by special adjusting screws. The ball-bearing roller freely rotated on the axle placed in the levers which are coupled on the pedestal of the driving apparatus installed behind the straightener. The straightening device is presently being put into operation.

The experience of mastering the lightened shapes on the 550-mill at the Enakiev Metallurgical Plant shows that by carrying out a number of technical measures the merchant mill trains of the old design can successfully produce economic rolled shapes needed by our national economy.

STAMPING METAL IN THE PRODUCTION LINE

Automatic Stamping of Hot Metal on the Blooming and Slabbing Mill

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The organization of stamping hot metal in the production line is important for ensuring an efficient and rhythmic operation, a considerable easing of the labor of the workers, and the output of quality products on the blooming mill.

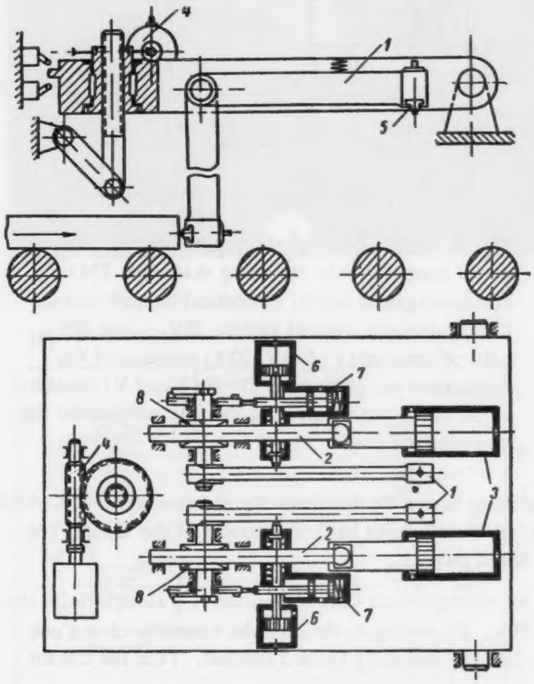

Fig. 1. Lay-out of the automatic universal stamping machine for blooms and slabs: 1) Levers; 2) rack rod; 3) cylinders for lifting the levers; 4) mechanism for lifting the stamping machine; 5) brand holder; 6) cylinders for stopping the levers; 7) air distributor; 8) toothed wheel.

In 1955 we installed on the blooming and slabbing mill of our plant a single-lever pneumatic stamping machine designed by the Ural Heavy Machinery Plant. This machine made it possible to cut in third the staff of worders branding metal, to ease considerably the working conditions, and to improve the branding quality.

However, in spite of the great advantages of introducing mechanized stamping of metal under conditions of a blooming mill producing numerous section sizes, this machine impede the productivity of the mill because it was impossible to stamp simultaneously in two strands; this caused interruptions in the blooming mill and necessitated manual control of the machine when rolling small shapes and sizes.

Based on operational experience with this machine, the Ural Heavy Machinery Plant in 1958 manufactured a two-lever stamping machine for the blooming and slabbing mill (Fig. 1).

The machine was installed over the roll table behind the shears and consists of a cast frame on which are mounted the air mechanism for moving the holder with the brands and an electric motor for moving the machine vertically. The holder with 13 brands is fastened in the groove of the lever by a stopper with a spring; the holder can be replaced in less than 5-6 sec. The brand is applied by the impact of the lever on the front end of the rolled product at the instant it moves along the roll table under the frame of the branding machine. The depth of the imprint is 1.5-2 mm, the height of the marks is 12 mm.

Extensible rims are installed in front of the branding machine to guide accurately the blooms and slabs as they move and to execute branding without stopping the roll table (Fig. 2). The rims can take slabs weighing up to 10 tons, the speed at which the rims move is 0.05 m/sec, their length is 4460 mm, their span is 180-1600 mm.

The use of extensible rims in this design together with a two-layer stamping machine makes it possible to stamp blooms and slabs in one or two strands and, for all practical purposes, to assure continuous operation at any productive capacity of the blooming mill.

Control of the stamping machine was made automatic * in order to produce quality stamping of the metal

*Engineers V. Butenko and G. Reshetnyak participated in the work of automating the stamping machine.

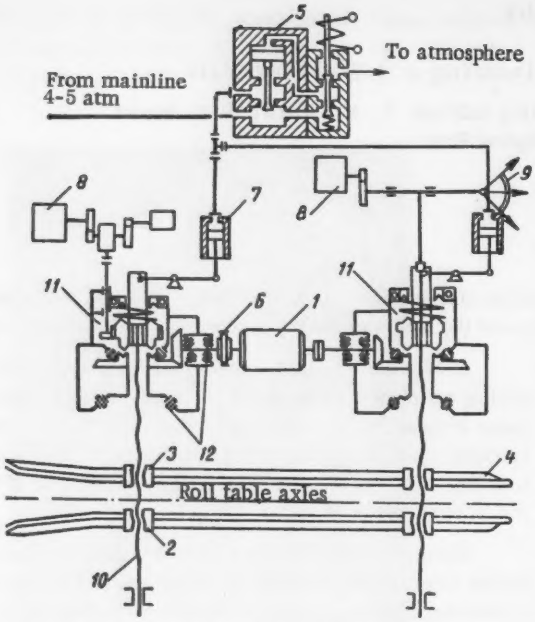

Fig. 2. Lay-out of the movement of the rims: 1) Electric motor; 2 and 3) nuts for the left and right threads; 4) rims; 5) air distributor; 6) brake; 7) air cylinder; 8) control apparatus; 9) indicator for shifts of the rims; 10) screws; 11) device for shifting the rims to the left and right; 12) roller bearings.

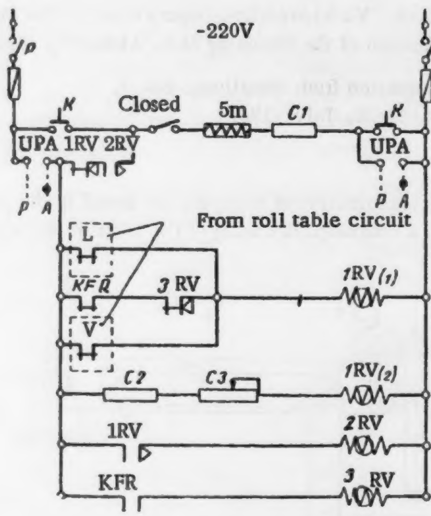

Fig. 3. Simplified circuit diagram of the automatic control for the stamping machine: EM) Electromagnetic valve; K) manual control button; UPA) automatic control switch; $1RV_{(1)}$ and $1RV_{(2)}$ coils of time relay of 1RV; KFR) contacts of the contactor-type photorelay FR-10; L and V) contacts of the contactor for starting the roll table under the stamping machine.

(Fig. 3). The stamping machine is switched on manually by pushing button K; this feeds the electromagnet EM which pulls the rod of the air distributor, the air enters the cylinder (Fig. 1) and draws back the stopper of the lever. The released lever with the holder turns and strikes the end of the rolled product.

The stamping machine is changed to automatic control by setting switch UPA to position A ("automatic"), the relay 1RV is fed through the normally closed contact KFR and 3RV. By cutting in the 1RV the normally closed contact to the EM circuit is opened and cuts in relay 2RV, which closes its normally opened contact. Thus the circuit is brought to the initial position.

When the photorelay is illuminated by the hot metal the normally closed relay KFR is opened in the 1RV circuit and the 3RV is cut in through the normally open contact KFR. The normally closed contact 3RV is opened in the 1RV circuit. The 1RV with a time lag drops out and closes the normally closed contact in the EM circuit and opens its own contact in the 2RV circuit. Since the 2RV relay has a time lag greater than the 1RV relay, the feed time of the electromagnet EM is sufficient for the lever to strike the metal. At the end of the 2RV delay the circuit goes to the initial position.

A remote photoelectric head is mounted on the frame of the roll table. When the roll table is not moving or when the metal moves backward, illumination of the photorelay and its spurious operation are possible, therefore the KFR and 3RV in the circuit of the coil $1RV_{(1)}$ are blocked by contacts L and V.

During unclear operations the KFR additionally opening at this time the normally closed contact 3RV assures clear operation of the circuit.

The described design of the automated two-lever stamping machine on the blooming and slabbing mill completely eliminates manual labor for stamping metal, assures a good quality of branding and a high output of the modern blooming mills.

AN UNDRIVEN STAMPING MACHINE ON THE RAIL AND BEAM MILL

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According to All-Union State Standard 7566-55 beams and channels should have a brand indicating the manufacturing plant and heat number.

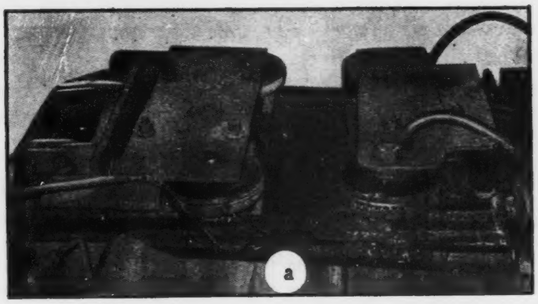
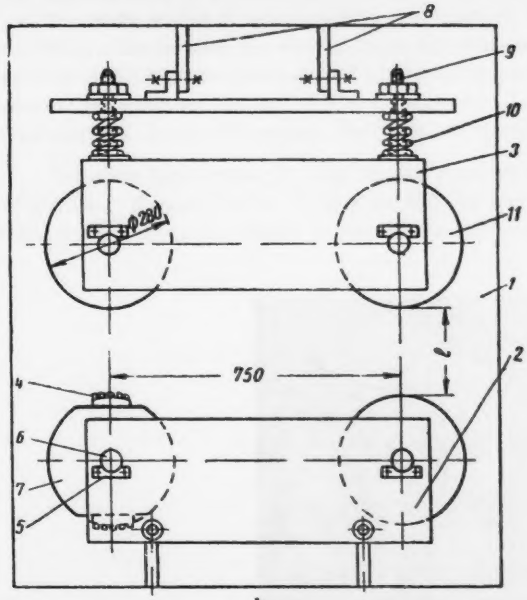


Fig. 1a. General view.

Fig. 2. Brand holder.



b

Fig. 1b) Undriven stamping machine: 1) Plate; 2 and 3) fixed and movable holders; 4) brand holder; 5) cross bar; 6) roller axle; 7) stamping roller; 8) hinge; 9) screw; 10) spring; 11) guide roller.

Until the introduction of a stamping machine, branding of rolled products was done by hand, which required that the movement of the rolled products on the roll table be stopped for 2-3 sec beyond the pendulum saws. Hand stamping held down the rate of cutting the metal and reduced the output of the 800-mill. In addition, hand stamping was a laborious operation for the stampers.

On the suggestion of V. I. Sorokin, L. N. Gorodetskii, F. V. Povar, and I. I. Zichenko a stamping machine was manufactured (Fig. 1a) that brands the rolled products on the go, thus completely eliminating the manual labor and improving the branding quality.

The machine consists of two holders (Fig. 1b) mounted on a common plate. One of the holders is bolted immovably on the plate, the other is hinged with the edges of the plate. The holder is adjusted to the working position by screws and springs. The distance l between the rollers of the holder is set 1.5-2 mm less than the width of the shape being rolled.

The axles of the guide and stamping rollers are fastened in the jaws of the holder. All rollers are mounted on antifriction bearing to which a thick lubricant is fed. The surface of the rollers are water-cooled by a sprinkler.

The holder with the brand selector (Fig. 2), which is fastened by a 20 mm diameter pin passing through the opening in the roller and holder, is inserted into the working roller.

To facilitate installing the brand, the holder is made separable and consists of a case and cover. The case has pockets for the brands, which are made of U7 steel, oil quenched and tempered. At the working place of the stamper there are four sets of brands and two pairs of holders, of which one pair is used during the work and the other is set up beforehand by the stamper.

The rolled product are stamped between the rollers of the stamping machine as they pass along the roll table leading from the saws. The friction force rotates the working rollers with the brands, which project 2-2.5 mm over its surface; the brands are impressed 0.5-0.6 mm deep into the web of the channel or beam. The spacing of the brands is 420 mm. Beams pass through the stamping machine at a speed of 2.1 m/sec.

As a result of installing the undriven stamping machine, four stampers have been released to do other jobs.

OUTSTANDING METALLURGISTS

G. Suvorov, A. Khinkis, and M. Churilin
Magnitogorsk Metallurgical Combine

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It is probable that there is not a single corner of our country where they do not know about the Magnitogorsk Metallurgical Combine, where they do not admire the exploits of its personnel. Thousands of undertakings and production lines get metal from MMK, to be transformed into tractors and locomotives, combine harvesters and automatic machines, excavators and turbines, building constructions.

Metallurgists at MMK were some of the first in the country to raise the banner of the struggle for communist labor. The earliest of all to enter the struggle for the title collective of communist labor were the blast-furnace workers of the Young Communist League - Youth furnace, and their example was followed by the workers in the wet magnetic separation division of the ore-beneficiation plant.

Before very long the entire collective of many thousands in the Urals giant was included in the struggle for the right to bear the high title of an undertaking of communist labor. Already at the combine there are the first shops of communist labor. These are the blast furnace shop and the wire-strip shop.

Shortly before the opening of the XXIst Congress of the Communist Party of the Soviet Union, the blast furnace workers at MMK unanimously resolved to struggle for the high title of a shop of communist labor. The party office and the shops trade-union committee first of all turned their attention to the organization of studies. Under the instruction of the managers, the furnace-men, gas personnel, the scale car machinists and water-pipe attendants, undertook a serious study of the technique of blast-furnace production. Thus they set themselves the task of studying perfectly all the trades so that if necessary they could replace one another. The same seminar courses were also created in other shops. Results were not slow in appearing. More and more frequently from the ranks of the workers, suggestions began to arise for the improvement of labor methods, and for the saving of raw material, fuel and instruments. In the course of the effort for the title of shop of communist labor, much attention was paid to economy in the use of material reserves. In the shift reports, the words "economy" and "saving" occupy a sure position.

Somehow furnacemen got onto the shop committee. "What's the use of this – Dimitrii Karpeta was filled with indignation – if there is some of the poker left, we throw it away or at best melt it in the channel during pouring. These remains should be welded up and the consumption of pokers reduced."

Blast-furnace personnel in the shop of communist labor.
Left to right: gas-fitter F. Sidorenko, and furnacemen
I. Kandakov and P. Mamaev.

Shop economists calculated that by this it is possible to save not a few but tens of thousands of rubles. The suggestion was adopted and introduced in production.

An example in skill in saving the state's kopeks was shown also by the bricklayers repairing pig-iron ladles. Formerly for this work the shop attracted, unknown to its bricklayers, workers from Soyuzteplostroe, and this involved much expense. The bricklayers suggested doing without the services of Soyuzteplostroe and undertook with their own efforts the repair of the whole ladle park. This saved the combine hundreds of thousands of rubles.

Frequently one may hear the blast-furnace workers talking of the shop technology group. On the top story of the routine building this distinctive laboratory has been placed. Here are tested out and then put into practice everything new and advanced, and this gives birth to creative ideas.

"Since our shop entered the struggle for the title of communist — relates the leader of the technological group, engineer P. Ya Shparber — the number of suggestions for improving the technique and technology of blast-furnace production has increased considerably. All our work is designed in close cooperation with the furnace teams. Therefore a great deal rapidly succeeds in being put into practice. Such was the case, for example, with the installation for the desulfurization of pig-iron inside the furnace, which we constructed, and then tested out and introduced into

Leading workers in the wire-strip mill, which has obtained the title of shop of communist labor. Left to right: roll- technician V. Nikitin and manager roll-technicians M. Raevnin and P. Usatov.

production in cooperation with the collective of one of the furnaces. This installation is now already working. Following the suggestion of managers and furnacemen on this furnace, a number of improvements were carried out. Many creative innovations were developed by the teams of the second and third blast furnaces in connection with the introduction of high magnesia slags, these make it possible to smelt pig-iron with a low sulfur content."

The last two years of the struggle for the high title of collective of communist labor have brought enormous success to the blast-furnace workers. On three blast-furnaces, the scale cars have been replaced by an automatic system of transporters, vibro-feeders and other mechanisms. In order to alter the loading regime, the furnace manager now has only to switch some levers on the control apparatus. All the rest is carried out automatically. And they do this much more accurately and rapidly than the scale car machinist did before.

The installations for the single-spout puring of pig-iron is the pride of the combine. Time and the furnacemen's energies are saved by them, losses of pig-iron as scrap are reduced, and industrial efficiency is raised.

Comparable installations are already appearing at other metallurgical undertakings in the country. But their birthplace was in our combine. Here they, like so many other innovations, first obtained their start in life.

"If we had not constantly forged ahead, but had stood still, we would not be a shop of communist labor — said

one of the most senior blast-furnacemen at MMK, head manager Aleksei Leont'evich Shatilin — Each year our shop increases its pig-iron production. Whereas in 1958 the coefficient of use of the effective volume was 0.615, in the first year of the seven year plan it was equal to 0.607, and in the following year 0.601. In the third year of the Seven-Year Plan our coefficient already stands at 0.596 - 0.599. Coke consumption per ton of pig-iron for this year has been reduced by almost 20 kg."

All this is the fruit of creative searching, of the unwearying refinement of technique. The maxim, the tradition, of Magnitogorsk blast-furnace workers is to forge ahead continuously. By their own creative labor, by bold moves they enrich not only the practice but also the theory of blast furnace production. For a long time certain scientists had asserted that the hot blast temperature should not exceed 900 - 950°C. The practice of Magnitogorsk, and then Cherepovetsk and Kuznetsk blast-furnace workers has refuted this opinion, and have demonstrated its erroneousness.

Much controversy was opened up amongst scientists with regard to the use of high magnesia slags. Here there was not, and even now there is not one single opinion. Opponents of the high magnesia slags consider that they will not have an adequate desulfurizing capacity. However the experience of the Magnitogorsk workers has pointed to the contrary.

In the theory of blast-furnace production, generally speaking,the question of increasing the output of pig-iron is still not elucidated. Nonetheless, this is a very important question. The Magnitorgorsk blast-furnace workers in their own experience became convinced that the more frequently the melt products are tapped, the more evenly and intensively the blast-furnace works. Now, for example, all the second block furnaces work according to a nine-unit output chart. This means that less than every three hours the furnace yields pig-iron. On the remaining furnaces the iron is tapped eight times in a shift.

The advancing movement onwards, the progress in production is inseparably linked with the advancement of personnel.

In the difficult years of the Great Patriotic War (World War II) Aleksei Bazulev entered the combine. His working career is the same path followed by tens of thousands of simple Soviet folk: furnaceman, foreman's school, the industrial technical institute. Now A. Bazulev is manager of the first blast-furnace.

Five years ago, having completed the manager's school, Bazulev carried out his diploma work on "A comparison of the working details of blast-furnace No. 1 in 1950 and 1959." Quite recently, by now the shop had been awarded the title of communist, by chance there fell into Aleksei Bazulev's hands the furnace journal for 1950, the same as he in his own time had made use of for his diploma work. The manager showed the journal to his comrades. Nearby on the table in the gas cab lay the production journal for October,1960. They decided to compare the details. And what did they find ? The coefficient of use of the effective furnace volume in 1950 equalled 0.80, and in October, 1960 it stood at 0.567. The average yield of pig-iron per shift had increased by many hundreds of tons. Then the proportion by weight of sinter in the charge had been 72%, now 95% of the charge consists of sinter. Coke consumption per ton of pig-iron was 800 kg, now it has been reduced to 608 kg. The temperature of the hot blast has risen from 600°C to 1000°C. In 1950 more than 300 settlements in the furnace were recorded. In practice this means that settlements occurred almost every day. In the whole of 1960 not a single settlement was noted. Ten years ago not only in isolated tappings, but sometimes entire shifts yielded unserviceable iron. Now they have put an end to this trouble for good.

But how many other striking changes have taken place in this comparatively short time! These changes have been engendered by the communist attitude to labor, by the growth of the conscientiousness of people, by their patriotic yearning persistently to take on the lines of the seven year plan.

Great successes have also been achieved by another shop of communist labor — the wire-strip shop.

Fifteen thousand tons of rolled products in excess of the plan, one and a half million rubles saved in excess of the plan from the reduction in cost of manufacture, an increase in labor productivity by more than 2% - such is the contribution, made in 1960, by the collective of this shop, to the business of fulfilling the Seven-Year Plan before time.

In the second year of the Seven-Year Plan, the shop produced half as much second grade material as in 1959. Because of the reduction in scrap, in addition to the plan more than ten wagons of rolled material were dispatched. The metal, rolled by the shop in excess of its yearly quota, is sufficient to satisfy the yearly needs of an average machine construction factory. And on the resources, saved by the collective of the wire-strip shop only in one year, a multistory residential block could be built with 40 units with every comfort.

The roll workers have also successfully begun the third year of the Seven-Year Plan. By the collective's traditions not only were rhythmical working, undisturbed turnover of production and continuous fulfillment of the plan maintained, but also the strict observance of all the orders of the national economy. As in the preceding year, so in the first months of the current year, all the orders obtained from the factory and from the country's production lines were accurately executed.

The efforts for communist labor bred many new and advanced shoots. It is no longer the timekeepers but the managers themselves who carry out the calculation of the yield of people at work. The staff of technical inspectors has been halved; by this the state will save more than 60 thousand rubles every year. All this is possible because of the growing conscientiousness of workers, the increase in their mastery of their trades, and the continual struggle for technical progress. The functions of technical inspectors have been taken over by the workers and managers themselves.

To the question of how this has reacted on production, the manager of mill 250, Nikolai Fomin, replied "Rejects and second grade material have been considerably reduced with us, because each worker at his post thinks of and is responsible for the production quality, and not only the manager and chief roll operative, as it was before." Comrade Davydov, the head of mill 250 No. 2, also spoke about this: "A large material gain has been achieved, but this is not the only point. A high regard for production quality is being inculcated with the workers - each thinks that he is now the inspector himself."

The wide spread of labor rationalization is an especially clear index of the growth of creative activity. Now all the workers continuously have regard as to what can be done to improve production and use internal reserves more fully. In the second year of the seven year plan more than 170 suggestions by inventive personnel were developed and implemented. Because of this more than 150,000 rubles were saved in the year.

On certain rolling mills even now the job of catcher has been retained, which requires great physical work. The idea came to chief foreman of mill 250 No. 1, Georgii Antonovich Galushkin, of eliminating the manual work in looping. One of the pieces of guiding apparatus with which the mill is now equipped made it possible to mechanize the rolling of round and bar steel in the first loop. Now preparations are going on to instale another guiding apparatus. It is designed to transfer the work-piece from the ninth to the tenth stand in rolling steel angles. This apparatus was made by G. Galushkin in cooperation with engineer A. Kugushin.

The teams of mechanic P. S. Kozlov, electrician K. D. Efimov, manager V. M. Kochetkov, mechanic F. I. Belan and many others are active rationalizers. Their creative ideas have saved the state not one but thousands of rubles.

On the doors of one of the shop's rooms is hung a notice "OKB." The public constructions office is situated here. Its inception is directly connected with the growth of technical creativity in the collective. When few suggestions were forthcoming, it was not difficult to develop draft plans. The staff designer chiefly coped with this matter. But with each year there were more suggestions, and the idea arose of creating in the shop a constructions office on public principles. Onto the OKB staff went young energetic engineers, qualified workers, having specialist training. Amongst them were A. Popova, G. Inkin, N. Lapteva, P. Sharapov and others, in all eleven people.

New designs for the rollers of the plate transporter on mill 250 No. 2, for the guides between working stands on mill 300 No. 2, for the drives to the billet lift-out attachment — these are only some of the innovators' suggestions which have been implemented with the help of OKB.

A study was begun of thė vital requirements of all the shop's workers, engineers and technicians. More than 150 people are studying at institutes, technical schools, the factory's manager's school and in working youth schools. The remainder study in the Party education system, particular attention being paid to the economics of production and Marxist-Leninist theory.

The roll personnel accepted the resolutions of the January, 1961 Plenary Session of the Central Committee of the Communist Party of the Soviet Union as applying directly to themselves. The fulfillment of agriculture orders is under the assiduous control of the Party organization and shop administration. As in the past, so in this year the shop's collective has not failed a single agricultural machine construction factory.

But assistance to agriculture has not only been expressed in this way. The shop is fulfilling well its own landlord commitments in relation to one of the collective farms of the Kizil'sk district of the Chelyabinsk province. Roll personnel have helped the collective farmers to be fully equipped to meet the spring of the third year of the

Seven-Year Plan. Recently new books appeared in the collective farm's library. The workers of the shop of communist labor had sent them from their own personal collections.

In these days the collective of the wire-strip shop together with all the metal-workers at MMK bear the worker's obligation in honor of the XXIInd Congress of the Communist Party. The roll personnel march in the vanguard of the struggle for a worthy welcome to this prominent event in the life of the party, of the entire Soviet people. Having taken upon themselves high commitments, the collective of the shop of communist labor sets an example by their successful fulfilment.

There is no doubt that in the preparation period for the Congress new shops of communist labor will appear at MMK. But the initiative of those who first earned the right to bear this high title will never be forgotten.

ADVANCE GUARDS OF THE FUTURE REACH NEW FRONTIERS

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As in previous years, the blast furnace shop at Cherepovetsk factory is running excellently; on the large furnaces the best coefficient of use of effective volume in the country is attained with a very small specific coke consumption.

Blast furnace team of communist labor. From left to right: F. F. Smirnov, Yu. D. Smirnov, V. I. Koregin (furnace manager) M. F. Gusev, N. N. Klyshichev, M. I. Tikhomirov.

Much merit in this is due to the shop collective, which does not relax its search for methods of further increasing the production of pig-iron. Here are some figure typifying the working of Cherepovetsk blast-furnace personnel for just over two years: 1959, coefficient 0.609; 1960, 0.577; April,1961, coefficient for the shop 0.517 and for no.1 blast furnace 0.502. Already in the first months of the struggle in honour of the XXIInd Congress of the Communist Party of the Soviet Union, new frontiers have been conquered.

What is the secret of these successes ? How has the achievement of such high figures been ensured ?

"This was the result of working the furnace on 100% self-fluxing screened sinter, of excluding manganese-bearing ore from the charge, using a high blast temperature (1040 - 1060°C), of raising the gas pressure under the furnace to 1.8 atm and of selecting the optimum regime of running the furnaces (continuously maintaining an even flow with maximum use of the energy of the gas stream)." Thus wrote the participants in the conclusions summarizing an inter-factory study-group.

But this is not quite so. About much that is not set out in the usual limits of the business of technical findings, there is nothing to comment, and yet it is difficult to state everything in the conclusions of a study-group. The shop's workers – the shop's head, I. A. Kuz'min, his deputy V. D. Kailov and any furnace assistant – replies each in his own way to the questions: What do you consider to be the main reason for these successes, what is their secret ? But the meaning of all the replies is the same: the urge of the collective to use everything so as to work better today than yesterday, and to work better tomorrow than today.

It is well known that one cannot go far on enthusiasm alone. But without enthusiasm no production collective, large or small, will fulfill the task set it. Therefore, when the Cherepovetsk blast-furnacemen embarked on the struggle for the high title of shop of communist labor, in their commitments, enthusiasm was adopted as a very important means and method of procuring and using all production reserves.

Blast-furnace No. 2 furnaceman N. D. Antonov and furnace manager V. M. Antonov watch iron being tapped.

To have knowledge and skill one has to study. Never before in the shop had questions of studying been so keenly put as in the course of the struggle for the title of collective of communist labor. "Study everything" - thus it was written in their commitment, and so it was carried out in practice.

Every week in the shop head's cab the engineers, technicians, managers and senior gas operatives meet at "technological Fridays." Discussion of the previous week's results goes on. The working of the furnace on each day is carefully analyzed, the reasons for successes and for failures. If deviations from the established technique, or breakdowns in working, are admitted, then in the first place they explain not how they were permitted, but what went wrong and how this should be avoided in future.

The leader of the scientific and technical section, V. D. Kailov zealously sees to it that theoretical seminars on questions of the latest achievments of metallurgical science and technique should take place frequently; this is also of interest for the benefit of practical work. In the previous year there were eleven seminars. Papers and reports were also discussed, for example: On works practice in the blast-furnace shops of the Magnitogorsk and Nizhni -Tagil combines; A project for the automation of the stoves of blast-furnace No. 1; Modern methods for the automatic analysis of blast-furnace gas; A project for a computer installation for control of the thermal state of the furnace; A project for automatically charging the blast-furnace.

The chief lectures at the seminars are the leading workers who have acquired great experience and those who still study in the soviet of young specialists with the factory committee of VLKSM *. Lively discussion of the papers takes place and frequently develops into an argument on principles, and there are sharp retorts but the main thing is there is no apathy. Such "technological Fridays" and theoretical seminars help in solving practical problems.

*All-Union Lenin's Young Communist League.

Blast-furnace technology is being improved, and experience and information are being accumulated. In the shop, courses in the required minimum of technical knowledge and the study of related jobs are continuously going on. This ensures full interchangeability in working positions and the capacity always to go to the help of a comrade in a difficult moment. The first assistant stands in for a senior furnaceman and confidently controls operations, many senior furnacemen successfully replace gas personnel, and the gas personnel replace managers.

A form of study, such as a school of advanced labor methods had been well recommended. In 1960 schools were held with furnacemen, transport machinists and charging teams. One aim was set for all the schools – to teach the furnacemen and charging workers the labor methods to effect a change-over to nine iron-tappings per shift.

The blast-furnace manager, engineer V. M. Antonov had studied for a month the advanced methods of teams of furnacemen led by I. S. Grechushkin, I. G. Kolobov and V. I. Zhil'tsov. He worked with them for several shifts, carefully studying and analyzing. Then he selected the most productive labor methods and prepared a brief clear description on which the studies of those taking part in the school were based. I. S. Grechushkin led the furnacemen's school.

The schools of advanced labor methods for transport machinists were just as carefully prepared and executed. In conjunction with other organizational and technical measures the schools effected the fulfillment of the problem set them. The blast furnaces were changed over in good time to nine tappings of pig-iron per shift. All the workers and engineer-technical personnel are studying. Among blast-furnacemen, 35 are external students at institutes and technical schools, and 40 men study in evening school. Furnacemen G. I. Grebnev, V. F. Golubev, electrical team-leader A. L. Shitov, mechanic P. I. Mikhailov and many others are skilfully combining distinguished study with highly productive work. Such a combination gives quite good results.

The struggle for communist labor has stimulated creative thinking in the blast-furnacemen, and some tens of workers in the shop have been innovators. In 1960 as compared with 1959 the number of innovators in the shop more than doubled; every third worker has brought in his own suggestion for the automation or mechanization of production processes, for raising labor productivity and easing labor conditions. In the year, 158 suggestions were introduced with a yearly saving of 626 thousand rubles. In the first three months of the current year, 36 suggestions were introduced into production. Differing in economic effectiveness and the degree of development of the proposed solution, they all bear witness to the creative attitude to work and to the concern of the ordinary worker with the raising of labor productivity.

A feature of the innovators' work in the blast-furnace shop is collective creative work, the cooperation of worker-innovators, engineers and technicians. The mechanics' team-leader A. L. Ivanov, manager-mechanic P. K. Sobolev and manager P. I. Borisov proposed to improve the measurement of charge-level in the blast-furnace. This eliminated gas contamination on the furnace staging and saved 2900 rubles by reducing gas losses. Of this joint team, comrades Ivanov and Sobolev proposed to redesign the crushing rollers of the pug-mills, which increased their service life and gave a saving in nonferrous metals of 856 rubles a year. A suggestion such as reducing the height of coke fall by a coke pillow, the introduction of which gives a saving in coke of 4460 rubles per year and reduces the amount of coke fines, was developed by a joint team, in which V. A. Vanchikov, V. M. Vitovskii, I. G. Gnezdilov, I. E. Kulakov and N. I. Grishanov took part.

A technical Friday. Deputy head of the shop for charging, V.M. Vitkovskii takes his turn.

Much use is also made of the experience of blast-furnace shops in the Magnitogorsk and Kuznetsk Combines and in certain southern factories.

A few, less than five, years ago, when the shop collective had only just been formed, the managers, engineers, furnacemen, and gas technicians, having come from the Kuznetsk, Magnitogorsk, Nizhni-Tagil and other undertakings, used to talk about their own working in fierce arguments and defend the advantages of "our Kuznetsk" technique and so on. S. I. Reznikov, who was director of the factory at that time said: "Based on experience accumulated and brought in from other factories, taking account of local peculiarities, we shall have to select our own Cherepovetsk style of running blast furnaces. Only thus shall we be able to achieve successes."

There were a few skeptics who contended that it was early to talk about their own way when the shop was making its first steps. But most blast-furnace workers adopted this idea with enthusiasm and eagerly undertook to carry it out. A very short time elapsed and life refuted the skeptic's contentions. There is indeed a Cherepovetsk style of running blast-furnaces, and this is acknowledged by all the country's blast-furnace workers.

Typical features in the working of the shop's collective are not only the boldness of engineering thought, the study and skilful use of blast-furnace capabilities, but also the high culture of labor in any position, the clear appreciation by each worker of the task in question and the methods of achieving it, the exactingness and implacability toward everything that concerns the interests of the job and of the collective. All work in this way, from the head of the shop to the pug-mill worker. There are no excuses for deviations from this precept, no-one will say: "It's nothing, it doesn't happen only to us."

Just as each treats the other with concern in production, the blast-furnace workers' pay not less attention to behavior in private life. If anyone has performed an unworthy act or has not conducted himself properly in his family, no-one condones the action and says that this is a "private affair." The collective always expresses its opinion.

Since they took up the struggle for communist labor, large changes have taken place in the spiritual life of the collective. Some tens of workers have resumed studies interrupted at some time for various reasons. Among the external students of institutes and technical colleges and night school students are not only the young; here there are not a few family men who can compare the ratings obtained by them in school with the successes of a son or daughter. Tourist excursions in the countryside around the town, collective trips with their families to the Rybinsk reservoir in summer, skiing excursions in winter, evening recreations, organized with the collectives of other shops in the Palace of Culture, these have become popular forms of recreation.

Many visitors have been attracted by an exhibition, organized by the Party office, of works by the shop's amateur artists, at which V. Petukhov, V. Kailov, K. Bugaev and others have exhibited their own works.

The lines of the communist tomorrow are clearly apparent in the life and actions of the advanced collective, with which the workers in other shop of the factory are catching up.

FOR COMMUNIST LABOR

Translated from Metallurg, No. 7,
pp. 32-34, July, 1961

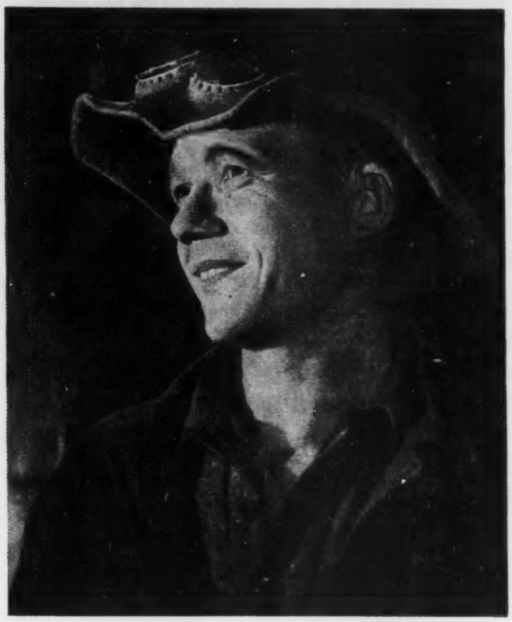
Elektrostal' Plant

All the metallurgical undertakings of the Moscow province sovnarkhoz (Council of National Economy) are striving for the honored title of collective of communist labor and for a fitting welcome to the forthcoming XXIInd Congress of the Communist Party of the Soviet Union.

In two years of the Seven-Year Plan the factories near Moscow have exceeded the plan by tens of millions of rubles of gross production.

With each day the struggle for communist labor takes on an all the more massive character. In it a new attitude to labor is appearing, new norms of behavior, under the force of which people are getting a high sense of responsibility, new lines of character and marked moral qualities.

In the working life, a new sense of competition is being born. Very recently, an Elektrostal' Plant steel worker, Nikolai Vasil'chikov, together with his team entered the pioneering struggle for the title of team of communist labor, and how rapidly this was taken up among the teams of steelworkers and electric furnace managers in all the melting shops, among the roll personnel, forgers, electricians — the entire factory collective. It was resolved, on 10th June, 1960, at a mass meeting, by all the many thousand of the collective to struggle for the title of factory of communist labor.



N. V. Vasil'chikov – the initiator of the movement for communist labor at the Elektrostal' Plant.

The electric-steel metal workers considerably overfulfilled the State plan for the second year of the seven year plan and are successfully attacking the 1961 positions.

The collective has resolved to complete the yearly program well beforehand and, by the time of XXIInd Congress of the Party, to produce, in excess of the plan, 3000 tons of high grade steel, 2350 tons of rolled products, to save 1.8 million kw-hr of electric energy, and to bring into production 30 new grades of steels and alloys. Moreover, Elektrostal' metallurgists have resolved to impart all their technical innovations and accumulated production experience to the Dneprospetsstal' Plant, with whom they have vied for 25 years, and also to other of the country's related undertakings.

Before taking on new commitments, Elekstrostal' metallurgists took into account all the production reserves. In each section,workers' meetings were held at which were determined methods of further raising labor productivity and of increasing production output; as well as this, at each point of the commitment a collection of suggestions was organized. Each worker in the factory had the opportunity of expressing his own remarks.

In the factory it was considered that the wide use of oxygen in melting steel, reduction of rejects and the better use of plant would save 2 million kw-hr of electric energy per year. These and many other suggestions, introduced in the course of discussion of socialist obligations, are already being put into practice.

The collective of No. 4 electric furnace, having risen to the worthy call in honour of the XXIInd Congress of the Communist Party of the Soviet Union, took on new enhanced obligations – to complete the third year's plan of the Seven-Year Plan well beforehand and to produce an additional 200 tons of high-grade steel (for the opening of the Congress, 175 tons), to reduce rejects by 5% in comparison with the previous year; as in the previous year to have nothing rejected because of chemical analysis; by working below the middle of the compositional range a saving in alloying materials is achieved; to save the State 40 thousand kw-hr of electric energy in the year.

In the same factory 50 steelworkers of No. 1 melting shop came forward with a new proposal – to melt steel with production norms 2-3% above the customary levels. One of the initiators of this proposal, Hero of Socialist Labor, Deputy of the Supreme Soviet of the USSR, A. Zhuravlev, considered that raising labor productivity only by one percent would increase the yield of steel for each factory worker up to 0.3 ton, and this represents thousands of new tons of steel in excess of the plan.

Great skill, knowledge of problems of economy, but the chief thing, a high sense of responsibility for the work of the whole collective – this is what makes it possible for our metallurgists to master everything new and to attain new frontiers.

Having assembled at the office of the head of the cold-rolling section, G. N. Novikov, the senior rollers, rollers, welders, managers and operatives resolved to consider together how to fulfill the tight plan. The mill's senior roller, A. I. Salmanov, proposed raising production norms by raising the rolling speed for rolled metal suitable for bimetallic sheet, strip which is used for refrigerators, and for fuel, electrical and automobile relays. Despite a certain loss in earnings at first on introducing this innovation, the rollers supported Comrade Salmanov's proposal, and this has raised mill productivity by 15-20%.

The proposal was also adopted here of reducing by half an hour the time lost in roll-changing, which is carried out almost once a month on each mill.

Senior rollers and welders took responsibility for instructing new workers entering the division, so as to prepare qualified cadres for a fourth shift being introduced.

A

The melting shop team of communist labor at the Elektrostal' Plant. From left to right, steel worker N. Morozov, assistants N. Nevzorov, M. Kharlamov.

A. I. Salmanov relates that five years ago on his mill 3.6 tons were rolled in a shift. Now two tons more of plate of the same dimensions is produced. 1100 kg of precision alloy sheet used to be rolled, now almost two and a half times more is rolled.

Senior roller V. I. Khokhlov has instructed 20 men; now they are working as senior and ordinary rollers.

An excellent rule has been put into practice and holds in the division; work well yourself — help a slow comrade, act so that he works not worse than you. Following this rule, Victor Ivanovich not infrequently puts roller M. Korzhilov in place of himself, and himself goes over to the neighboring plant to see how things are going with the senior rollers of the mill.

The friendly united collective has clubbed together in this division. There are now produced here as many precision alloy sheets as were provided for by the plan for 1965.

Not long ago the collective of the division was awarded the high title of collective of communist labor.

Everywhere in the factory signs of new things are to be seen. In the oxygen shop, which was one of the first to be awarded the title of shop of communist labor, wages are given out without a cashier. By their own efforts the shop's collective inspected and installed air and oxygen compressors.

At the beginning of 1960, by the initiative of B. Popov, an engineer in the research laboratory, an effort was undertaken for the creation of engineers' personal investments in the Seven-Year Plan fund. The laboratory's whole collective pledged itself to save the country 500 thousand rubles by the end of the year. B. Popov and his comrades

B

Head of the cold-rolling division, G. N. Novikov, explains a new welding technique to his welders.

overfulfilled their obligations by a factor of two. Steelworker A. Krutov's team (No. 2 melting shop) under the leadership of manager S. Paderin carried out a rapid electric furnace repair. Whereas the norm for a cold repair is 12 hours, the electric furnace was put in order in 7 hours 35 min. The following took part in effecting this rapid repair: assistant steelworkers N. Prikhod'ko, I. Druzhinin, spout-maintainer E. Korovin, pourer N. Gurko, bricklayers A. Kondrashkin, N. V'yugin and P. Lachin. In the time saved in repairing the furnace more than 20 tons of steel were produced.

In the effort to welcome the XXIInd Congress of the Party worthily, the steel-melters are saving time in all operations and are achieving successes. And time is steel.

Following the mastery of the new technique, the factory's collective shouldered obligations, to commemorate the XXIInd Party Congress, of producing 440 tons of high-grade metal obtained by the electroslag remelt method. This obligation is being successfully fulfilled.

This year the electric steel workers decided to sum up their efforts and to execute orders not each month, but every day. Experience shows that this considerably improves management by socialist competition, makes it possible in operation to eliminate factors holding up the fulfilment of socialist obligations, raises labor productivity, markedly reduces accidents, strengthens work discipline and reduces rejects and lost time.

Daily supply of returns not only shows how things went yesterday, but it also checks the fulfilment chart and this exerts a beneficial effect on the working regime.

Such a system has been introduced at all the metallurgical undertakings in the Moscow regional sovnarkhoz. This initiative should be applied everywhere, in all the undertakings and factories in the country.

One of the Leninist principles of competition — comrade mutual help — is strongly upheld in the team of communist labor of the roll-lathe workshop of No. 1 shop. The experienced worker, A. I. Arkhanukhin, a highly qualified roll-lathe operator, leads this team.

The collective is successfully coping with the fulfilment of output norms, and is producing a high grade of roll-turning work. But in the course of the struggle for communist labor new features also appeared.

The steel rolls on mill 600 often broke down, and this meant time lost on the plant and losses of metal. The team established a careful check on the condition of the rolls. And these are the results. In 1958 there were three breakdowns and three were prevented; 1959, two breakdowns and three prevented; in 1960, not a single breakdown and three prevented. The team works without inspectors.

In the struggle for communist labor the metal workers in the metropolitan province are persistently and unswervingly achieving new successes in labor, in studies and in the strengthening of socialist discipline in industry and in outside life. The job is difficult and demanding, there can be no haste in it, ballyhoo and window-dressing cannot be substituted for it; similarly, it cannot be achieved without a sense of purpose. The words of V. I. Lenin should always be kept in mind: a highly honored title has to be won by long and persistent work, by proved practical success in really communist construction.

B. Chusov

Secretary of the Moscow regional committee of the trade-union of workers in the metallurgical industry.

Lepse Plant

The collective of the Lepse metallic mesh Plant also decided to struggle for the title of factory of communist labor. After the obligations had been taken up, there was a considerable revival of activity in the shops. Here there are their own front-rank workers, their own shock-workers from whom we can take an example, who can be followed. The front-rank shift in the weaving shop under manager F. A. Galkin systematically fulfils the state plan by 108-110%. In honor of the XXIInd Congress of the Communist Party of the Soviet Union, the shift's collective pledged themselves to fulfill the annual plan by 20 December,1961, thus saving 1208 rubles in secondary materials and 2000 kw-hr of

electric energy. For a long time there has not been here a single case of a violation of production or labor discipline. Not long ago the shift was awarded the honored title of collective of communist labor.

Men working in this shift constantly think about how to increase labor productivity, how to reduce working time spent on a particular operation, and how to improve the quality of the product. A shock-worker of communist labor, the mechanics' team-leader M. A. Pilevin,suggested metallic pinions on spiral lathes to replace textolite. This reduced noise, made things run steadily, and the lathes started to work much more flexibly. Another suggestion, no less important, was the packaging of metallic netting in paper instead of matting: this has reduced expenses on packing materials by a factor of forty, without reducing packaging quality.

The weavers in the loom factory are not lagging behind. In the loom shop, I. N. Zhuchkov's fine-mesh team serves as a shining example. In their struggle for the title of team of communist labor they have systematically achieved the over-fulfilment of production tasks. The whole shop is included in the struggle for the title of shop of communist labor. For the XXIInd Congress of the Communist Party of the Soviet Union the shop's collective has pledged itself to produce 25 thousand square meters of mesh for the needs of agriculture.

Something should also be said about the collective of the wire shop, who decided to carry out the hot-tinning of wire in protective gas atmosphere. The introduction of this measure will save the state more than one million rubles.

The entire collective of the Lepse Plant, struggling for the title of factory of communist labor, decided to review its initial commitment,and in honor of the XXIInd Congress of the Communist Party of the Soviet Union to complete the annual plan not by the 27th December but by the 24th December,1961 and to produce 100 thousand rubles of additional products by preparing 40 tons of steel mesh; to complete all deliveries for export orders by 1st December,1961; to reduce expenses on each ruble of goods produced by 0.5% as compared with the plan and to produce a total saving in excess of the plan of 30 thousand rubles; to raise labor productivity as compared with the plan in 1961 by 0.2%; to save 110 tons of fuel, 500 thousand kw-hr of electric energy; to include not less than 700 workers and engineer-technical workers with every form of general educational, technical, economic and political ability.

Thus live and work the metal workers in two factories near Moscow who have decided to become undertakings of communist labor. Very ordinary, simple folk are struggling for this title. Their heart beats in time with the giant heart of our Motherland, confidently marching on toward communism.

B. Chusov

Secretary of the Moscow regional Committee of the trade-union of workers in the metallurgical industry.

Hammer and Sickle Plant

The day is not far off when the XXIInd Congress of the Communist Party begins its work. To meet this remarkable event in the life of our country, to come to the opening of the session with new production successes — this is what each member of the collective of many thousands of metropolitan metal workers is thinking about.

The collective of the Moscow Hammer and Sickle Plant, having taken up the struggle for the title of undertaking of communist labor, has adopted increased socialist obligations and is successfully fulfilling them. The first teams and shifts, struggling for this high title, appeared in the factory shortly after the news of the initiative of the collective of the Moscow marshalling yard depot spread round the whole country.

The collective of the second shift on mill 250 of the section-rolling shop, where N. A. Yunichev is manager, was one of the first to enter the new stage of the struggle.

Roll personnel of mill 250, who have been awarded the high title of collective of communist labor.

On that day the mill roll personnel gathered at an extraordinary meeting. There was animated discussion about entering the struggle for communist labor. They considered, talked over and argued about what obligations to take up and on what to place particular importance.

Obligations were taken up and its objectives were developed in three directions: work in production; study; and daily life and the education of new qualities. But the adoption of obligations was only part of the business. The chief thing was to fulfill them; and not simply to fulfill them, but also to find something new, necessary in the education of the qualities of men of the future.

Much had to be weighed and considered by the mill's senior manager A. A. Ivanov, and by the shift managers E. I. Bodrov, N. A. Yunichev, M. I. Leonov and S. I. Fokin. It was not easy for the roll personnel of mill 250. Very varied difficulties arose; they fought with them and overcame them. In the second shift collective, for example, there were many inexperienced workers. In order to become competent in their job, they were faced with studying and studying. But the production plan had to be fulfilled, high quality products had to be produced, and, as is well-known, quality depends on skilled workers, on how far they have mastered the technique, how well they understand the technology.

The shift's Party group organizer S. F. Perov recalls: "What was to be done? Not to search for skilled workers elsewhere. And it was decided – to fulfill the plan and get skilled in related jobs. For half a year the entire shift's collective was engaged in this. And results were not slow in becoming apparent."

Setting up the mill for rolling metal of another profile was formerly done only by the roll personnel. Now all the workers carry this out. They complete the setting-up in their own sections and at once hurry to help their comrades. "Now," continues S. F. Perov, "we start up the mill in 10-15 minutes less. And the reward of each ten minutes gives a saving of hundreds of rubles."

There were few deficiencies in the work of all four shifts on mill 250. But people thought: this itself is not adding to our success, it must be put right. Problems of the quality of the rolled product, of the modernization of equipment, of the correct use of working time, of production reserves and of labor discipline were solved.

Many changes took place in the collective from the moment it entered the struggle for communist labor. The sense of responsibility for the general enterprise, for the future of each member of the collective, was raised.

On the eve of the 90th anniversary of the birth of V. I. Lenin, the mill's third shift, led by manager M. I. Leonov, was awarded the title of shift of communist labor. This collective had very high production figures, and had successfully fulfilled the obligations taken on. The mill's other shifts still had to work and work in order to gain the honored title. How often it was like this: ahead in all figures, but suddenly something unexpected .... Well, what has not been foreseen cannot be allowed for. And with renewed efforts the men would set to work again. "We have achieved high production figures and strengthened labor discipline – states a roller of the first shift, communist I. K. Avren'ev – in the near future at the next meeting of the shop's trade union committee they should have considered the question of awarding our collective the title of shift of communist labor. But one of the workers came to work drunk and this let down the whole collective."

On the mill not a single case of violation of labor discipline went unremarked, the collective was persistently engaged with the reeducation of careless workers, the roll personnel earnestly discussed at their meetings those who violated discipline, held up work and behaved themselves improperly in outside life. And the collective has been successful – from the beginning of 1961, there has not been a single case of absenteeism.

For two years the mill's collective has struggled for the honored title. On the preparation day for the May Day celebration the roll personnel of mill 250 were awarded the title of mill of communist labor.

In the first quarter of the third year of the Seven-Year Plan, the mill's roll personnel produced hundreds of tons of finished rolled product in excess of their task. Rejects were cut considerably; in March, for example, they stood at only 0.35%. Losses from rejects in the first quarter of this year as compared with the average quarterly losses in 1960 were reduced by 5030 rubles.

The collective's success did not arise by chance. The roll personnel paid great attention to the use of internal reserves, to the reduction of lost time and to the raising of labor productivity and of the yield of good material.

The most important role in the organization of production belongs to the mill's managers, with senior manager A. A. Ivanov, who has been awarded the title of shock-worker of communist labor, in charge.

Many people could be named, who by their efforts have contributed to the notable successes attained. There are L. Ya. Sadikov and I. A. Savel'ev, A. I. Letukhov and P. I. Mansurov, Yu. K. Zarubin and I. A. Podgornov, S. F. Perov and I. K. Avren'ev and many others. And, perhaps, it would be difficult to find a person in the collective who has not made his contribution to the general business, who has stood aside.

The collective of mill 250 is a big friendly family that will take any task on their shoulders. The roll personnel are increasing their skill, and are taking part in public activities. 35 men are studying in working youth schools, in technical schools and in institutes. The others are engaged in the groups of the political education system and are studying concrete economics. In the work of the voluntary people's guard 80 men take part.

The roll personnel of mill 250 carry with honor the workers vigil devoted to the forthcoming Congress of the Party. After 15 days in May the collective of communist labor produced tens of tons of metal above the plan.

In N. A. Yunichev's shift the roll personnel have achieved a very high output on the mill. After 12 days in May it stood at 117.6%. The pioneers of the future are working at a productivity level as high as this. There is still much for the collective of mill 250 to work out, but one thing cannot be denied: they are going along the right path.

M. Ul'chieva

General editorial secretary of "Martenovka." the newspaper of the Hammer and Sickle Plant.

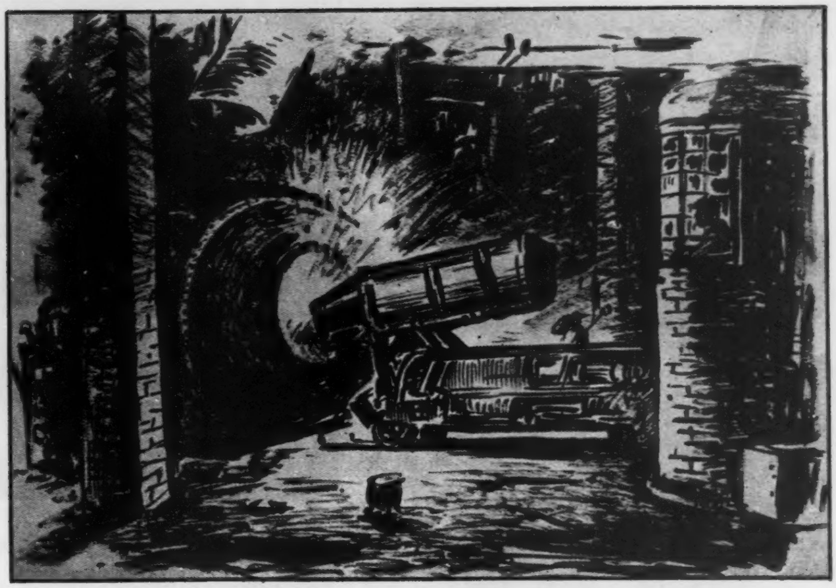
THE STEELMAKERS OF KRIVOI ROG

N. D. Gromov

Translated from Metallurg, No. 7, pp. 37-39, July, 1961

The construction of a new converter, was completed in June, 1959 at the Krivoi Rog Metallurgical Plant. The shop smelts rimming, killed, and low-alloy steels (35GS and 25G2S) in the basic converters by top-blowing the pig iron with pure oxygen.

Two mixers of 1300 tons capacity, as well as a machine for removing the blast-furnace slag and a device for removing the graphite were installed in the mixing department for continuously supplying pig iron. Three feed bins,



Charging the metal scrap with the new charging machine constructed in the shop.

ore, lime, and bauxite, are located over each converter at a height of 22. 7 m. From these bins the materials enter the weighing bins and are charged by a feeder along an extensible chute into the converter.

Oxygen is fed to the converter by a Γ -shaped water-cooled tuyere having a copper nozzle. The diameter of the nozzle is 65 mm; the oxygen delivery is 120-130 m^3/min; the pressure 6-8 atm.

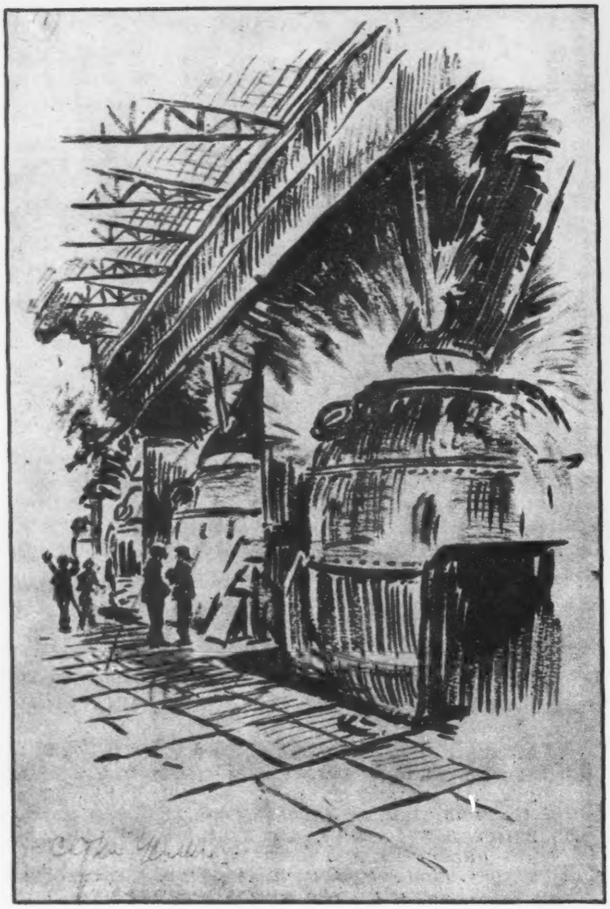
The gases which form in large quantities when blowing the metal with oxygen are fed through a water-cooled caisson to the lined part of the stack and farther along the gas line to the scrubber from which it is delivered to the Venturi Tubes, then to the cyclone gas-washer having a diameter of 3.6 m, and finally to the chimney (65 m high).

The dust content on the flue gases is about 150 mg/m^3.

Charging the converter with materials and scrap for cooling the metal is completely mechanized. The entire system of oxygen delivery has monitoring, measuring, and signaling devices.

Shift Chief G. M. Lyukimson (right) gives instructions to the smelting foreman V. F. Aksenov.

Pouring rimming steel KZkp. Left to right: Pourer A. Ya. Ryzhkov, pouring foreman A. P. Zhelyazkov, and senior pourer M. S. Lomakin (part of the Brigade of Communist Labor)



T. F. Gnezdilova, Shift Chief of the express laboratory of the Bassemer shop, behind analytical scales.

The technical and economic indexes of the shop's work and the quality of the smelted metal depends to a considerable degree on the quality of the raw materials being used.

The pig iron used in the shop has the following composition: 0.50-0.80% Si, 1.0-1.4% Mn, 0.030-0.055% S, and 0.09-0.11%P. The high content of silicon complicates the thermal and slag conditions, makes dephosphorization more difficult, lowers the yield of molten steel and the life of the converter lining. The optimal content of silicon in the pig iron for the process under consideration is 0.4-0.6%.

The rate and character of slag formation depend on the quality of the fluxes used, the lime and bauxite. The lime should be freshly calcined (without burning or incompletely burned materials) with piece sizes of 20-80 mm while the content of incompletely burned materials should not be more than 20%; the content of CaO should be not less than 85%, and sulfur not more than 0.20%. When such lime is used an active, fluid slag rapidly forms with a basicity of not more than 2.5 and favorable conditions are created for desulfurization and dephosphorization of the metal.

Because it is difficult to calcine uniformly the lime with a gaseous fuel in large cross-sectional furnaces, the plant still has not found the optimal conditions of their operation. The calcined lime used in the shop, therefore, contains a large amount of incompletely burned materials (40-50%). Such lime absorbs much heat in the converters and precludes the possibility of using a considerable amount of iron ore. The plant is presently carrying out investigations to improve the technology of calcining limestone.

The pig iron is poured into the converter from a ladle of 40 tons capacity. Delivery of the hot-metal cars to the converter and pouring of the pig iron are controlled from a special panel. The nozzle is set 800-1000 mm from the level of the bath when blowing the oxygen. The tuyere over the bath is moved so that the required speed of blowing, slag formation, and the life of the tuyere are simultaneously assured.

The lime and ore are added in two processes. The duration of the first blow period is 7 min, then the converter is tilted and the first slag poured; this requires 1.5-2.5 min. Losses of metal carried out by the slag as regulus and mechanical losses arising from tilting the converter are unavoidable during pouring. A sufficiently high degree of

dephosphorization and desulfurization is assured when the first slag is not poured off. In addition to this, the yield of suitable metal is increased by about 0.5% as a result of eliminating the loss of metal in the slag being poured off; the duration of smelting is reduced by 1.5-2.5 min. The phosphorus content in the steel in this case is increased negligibly (usually most of the heats have a phosphorus content up to 0.025% and sulfur up to 0.040%) and the life of the lining is not lessened.

Intermediate pouring of the slag is not necessary when smelting low-carbon rimming steel.

When smelting killed steel the slag is poured after blowing and lime again added, after which the metal is blown to a predetermined carbon content.

During the blow a considerably greater amount of heat is formed in the converter than is needed for heating the bath to the required temperature. Usually this heat is used either for reducing the iron ore or for fusing the steel scrap. When iron ore is used the yield of molten steel is increased and the consumption of gaseous oxygen reduced. However, as a consequence of a SiO_2 content up to 15% in the iron ore the amount of slag and its acidity are increased, which adversely affects the life of the converter's basic lining.

Iron ore is presently used in the shop for cooling the metal. The assembly of special charging machines for introducing the metal coolants in an amount of 15 kg/ton of steel will soon be finished. Taking into account that the price of steel scrap is 17 rubles per ton and that pig iron from the mixer is 31 rubles 60 kopeks per ton, the realization of this measure will improve the technical and economic indexes of the shop's work.

To increase further the output of the shop it is necessary to reduce down times for reconditioning the stacks and caissons. To increase the life of the caissons the shop started using water-cooled plate instead of magnesite-chromite bricking. The life of the stack lined with magnesite-chromite is usually 600-1000 heats, and the stack with water-cooled plates withstood more than 8000 heats on one of the converters. The shop used caissons of a new design with an increased delivery of water. One such caisson lasted three months. To increase further the output of the shop it is also necessary to reduce to a minimum the down times resultant of the absence of pig iron, additions, and oxygen.

In 1960 these idle times comprised 6.6% of the total shutdown times. It is also necessary to eliminate idle times which arise during shift changes.

An increase in the durability of the converter linings is of importance for improving the work of the shop. In 1960 the average life of the lining was 120.8 heats, and in individual furnaces it was 176-178 heats. To increase the life it is necessary to reduce the silicon content in the pig iron, maintain a slag basicity of not less than 2.5, and eliminate over heating of the bath by the addition of metal scrap. The accomplishment of these measures will permit an increase in the shop productivity, improve the technical and economic indexes, and expand the assortment of steel.

In the converter shop the heats follow one after the other through relatively short intervals of time. The rapidity of the operations demands from the shop collective well-defined and orderly arranged operations, which can be attained by good organization. The patriotic movement for the right to be called a Collective of Communist Labor was conceived in the shop when the converters were first started up. The first to be awarded this high rank in the shop was the No. 2 brigade headed by Shift Chief G. M. Lyukimson and Foreman V. F. Aksenov. This brigade attained the highest technical and economic indexes. Deserving of considerable merit in this matter is the pouring brigade of Foreman A. P. Zhelyazkov that reduced to a minimum the loss of metal during pouring and attained high-quality ingots.

A qualitative and timely analysis of samples of the metal and slag is of considerable importance for the successful carrying out of smelting.

The well coordinated and defined work of the chemists of the express laboratory, headed by Tamara Gnezdilova abets the successful work of the Brigade of Communist Labor. Even though she has worked only two years in the express laboratory after graduating from the Dnepropetrovsk Coke By-Product Technical School much good can be heard concerning the work of the shift that she heads.

In order to search for new reserves for a rapid increase in smelting metal by modernizing the existing equipment and improving the technology of production, the collective of the converter shop, having discussed their potentialities at workers' and open-party meeting resolved to take a number of measures in the shop that will foster a rapid increase in steelmaking. The decision was made to reconstruct the stacks and caissons of the converters and to install exhaust fans. The installation of charging machines at all converter shops will soon be completed and this will permit the

introduction of metal additions for cooling the steelmaking bath and consequently will increase the output of suitable metal. Steel will be teemed into ingots weighing 12.5 tons and this measure will simultaneously lead to an increase in the productivity of the blooming mill.

The collective of the converter shop is going all out to produce metal in excess of the plan and will appropriately celebrate the forthcoming 22nd Congress of the Communist Party of the USSR.

A RAILROAD CAR FOR TRANSPORTING CALCINED DOLOMITE

V. Z. Lavrenov, V. Ya. Tsekhmeister, and S. M. Livshits

Makeevka Metallurgical Plant
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Until recently, calcined dolomite was transported in open railroad cars to the metallurgical plants of the Stalinsk economic region. This entailed considerable manual labor when unloading the dolomite into the receiving pits of the charging yards for the open-hearth shops. Attempts were made to transport calcined dolomite in cement cars, however this did not prove to be of value.

On the suggestion of the workers of the Makeevka Metallurgical Plant, the planning and design department for mechanization and automation of intraplant railroad transportation developed working drawings. The railroad car depots of the Makeevka Metallurgical and the "Azovstal' " Plants were reequipped with 40 ordinary four-axle gondolas for transporting the calcined dolomite. Number 6 and 5 channels, to which were fastened overhead ribs, were welded to the upper frameworks of the gondolas. A roof of sheet steel 4-mm thick was laid over the ribs and eight loading hatches equipped with covers and one manhole equipped with a ladder were cut into the roof. A window, which is covered by a lid, was cut into the car wall. The window serves to light the car for cleaning after unloading. The end doors of the gondola were tightly sealed.

The dolomite is unloaded through the bottom hatches of the gondola.

Reequipping made it possible to release 26 loading men, which saved 43,000 rubles per year, whereas only 20,000 rubles were spent for the reequipping itself.

In addition to the calcined dolomite, it is possible to transport other bulky loads which are adversely affected by precipitation.

A RATIONALE FOR [illegible]

[illegible]

[illegible]

SIGNIFICANCE OF ABBREVIATIONS MOST FREQUENTLY ENCOUNTERED IN SOVIET PERIODICALS

FIAN	Phys. Inst. Acad. Sci. USSR.
GDI	Water Power Inst.
GITI	State Sci.-Tech. Press
GITTL	State Tech. and Theor. Lit. Press
GONTI	State United Sci.-Tech. Press
Gosénergoizdat	State Power Engr. Press
Goskhimizdat	State Chem. Press
GOST	All-Union State Standard
GTTI	State Tech. and Theor. Lit. Press
IL	Foreign Lit. Press
ISN (Izd. Sov. Nauk)	Soviet Science Press
Izd. AN SSSR	Acad. Sci. USSR Press
Izd. MGU	Moscow State Univ. Press
LÉIIZhT	Leningrad Power Inst. of Railroad Engineering
LÉT	Leningrad Elec. Engr. School
LÉTI	Leningrad Electrotechnical Inst.
LÉTIIZhT	Leningrad Electrical Engineering Research Inst. of Railroad Engr.
Mashgiz	State Sci.-Tech. Press for Machine Construction Lit.
MÉP	Ministry of Electrotechnical Industry
MÉS	Ministry of Electrical Power Plants
MÉSÉP	Ministry of Electrical Power Plants and the Electrical Industry
MGU	Moscow State Univ.
MKhTi	Moscow Inst. Chem. Tech.
MOPI	Moscow Regional Pedagogical Inst.
MSP	Ministry of Industrial Construction
NII ZVUKSZAPIOI	Scientific Research Inst. of Sound Recording
NIKFI	Sci. Inst. of Modern Motion Picture Photography
ONTI	United Sci.-Tech. Press
OTI	Division of Technical Information
OTN	Div. Tech. Sci.
Stroiizdat	Construction Press
TOÉ	Association of Power Engineers
TsKTI	Central Research Inst. for Boilers and Turbines
TsNIÉL	Central Scientific Research Elec. Engr. Lab.
TsNIÉL-MÉS	Central Scientific Research Elec. Engr. Lab.-Ministry of Electric Power Plants
TsVTI	Central Office of Economic Information
UF	Ural Branch
VIÉSKh	All-Union Inst. of Rural Elec. Power Stations
VNIIM	All-Union Scientific Research Inst. of Meteorology
VNIIZhDT	All-Union Scientific Research Inst. of Railroad Engineering
VTI	All-Union Thermotech. Inst.
VZÉI	All-Union Power Correspondence Inst.

Note: Abbreviations not on this list and not explained in the translation have been transliterated, no further information about their significance being available to us – Publisher.